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THE IRON TRADE REVIEW

VOLUME XXXIII. CLEVELAND, O. JANUARY 25, 1900. CHICAGO, ILL. NUMBER 4

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THE IRON TRADE REVIEW

VOLUME XXXIII. CLEVELAND, O. JANUARY 25, 1900. CHICAGO, ILL. NUMBER 4

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The wait in the iron market continues and still the facts disappoint those who would make a weaker situation by calling it such, or who impute to the iron trade tendencies that may appear in other quarters, financial and commercial. If expectations of a decline in pig iron would bring it, it is past due; if precedents were to be relied on, the time that has elapsed since the top was reached has certainly been sufficient to cause a retrograde movement. But it has not set in and there are no grounds in recent events or in present conditions for saying that it is near at hand. Important buyers are still hoping that the change for which they are waiting will come, but at the same time they are not confident that it will. On the other hand there are none in the trade who would exert themselves to advance prices farther; the sentiment is general that they are high enough, while many producers would be glad to have them lower, if they could be brought down without hurtful dislocations. Looking at the situation from the standpoint of probable consumption there can be no doubting its present and prospective strength. On the steel side the promise of shipyard, car works, railroad construction, and bridge and architectural requirements throughout the year is remarkably good, as is the outlook for the great wire industry. Those who have taken pains to get some idea of the probable requirements of foundry iron in 1900 report that the canvass, so far as returns are in—and these include many of the most important foundry interests in the country—show a very general increase, the percentages ranging from 30 to 60 over the tonnage melted in 1899. Taking cast iron as a gauge, the prosperity of the multitudinous industries whose operations make large drafts upon the foundry, is not yet at its climax. The official pig iron figures for 1899, just collected, show that the production of foundry and forge iron increased 21½ per cent over that of 1898, while in Bessemer iron the increase was but 12 per cent As is well known, the increase in consumption if it could be put in figures, would emphasize the difference in favor of the cupola and the puddling furnace. The business of the last week has given further demonstration of the firmness of Bessemer and gray forge irons in the Central West, 10,000 tons of the former being sold at $24, at furnace, while $21.50, at valley furnace, is the basis for Northern gray forge, or $1 in advance of Southern forge. Similarly in the Chicago district Northern foundry irons are scarcer and higher relatively than Southern grades. The rail purchases since the opening of the year have been noteworthy in the Chicago district, 40,000 tons having been sold, while fully 40,000 tons more is under negotiation and will probably be closed soon. A portion of these rails is for Canada. Structural demand is the most noteworthy feature of the market. The New York rapid transit tunnel work, as noted elsewheree, will take 65,000 tons of setel, of which one-third will be wanted this year, delivery beginning next month. It is practically settled that the steel will be furnished by the Carnegie Steel Co. Chicago reports from 12,000 to 15,000 tons of structural steel closed in the week or being figured on. Sheets are firmer, some Pittsburg mills quoting $1 to $2 above the prices ruling early in the month. The prospects of the sheet mill consolidation being made are excellent.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
705 PUBLICATION BUILDING, Jan. 24.

Sales of 10,000 tons of Bessemer and 2,000 tons of gray forge are the principal transactions reported here during the past week. These are without doubt the largest sales of pig iron in this district this year, and the fact that they were based on present quoted prices would indicate that pig iron is not weakening. The steel market continues quiet. The manufacturers are not coming into the market to any extent, as they have sold their output many months ahead, and they argue that the consumer must come to them sooner or later, and when he does, the price of steel will advance instead of decline. So far the consumer has shown no intention of helping to advance the market. The scarcity of coke, together with short car supply, is one of the features of the trade that is exceedingly annoying to foundrymen, as it has been for some time to furnacemen. As a result coke in small lots is steadily advancing.

PIG IRON.—The inquiry for Bessemer iron for delivery the first half continues, and during the past week sales of 10,000 tons for delivery at Pittsburg are reported. A sale of 2,000 tons of gray forge at valley furnace is also reported. Inquiry for 4,000 tons of foundry is also reported and the market is firmer than it has been for several weeks. Prices on Bessemer are being strictly maintained, as well as on forge and foundry irons. Outside of sales noted above there is little doing. The foundrymen are holding off with their purchases and the maintenance of the present prices is simply a question of whether consumers or furnacemen can wait the longer. Nearly all the furnaces are sold up to the end of the first half and the indications are that prices will have an upward instead of a declining tendency when buyers come into the market. We quote as follows:

Bessemer, valley furnace	$24.00	to	$24 35
Bessemer, Pittsburg	24.90	to	25 25
No. 1 Foundry	23.75	to	24.00
No. 2 Foundry	23.00	to	23.25
No. 3 Foundry	22.25	to	22.50
Gray Forge, valley furnace	21 50	to	21.75
Gray Forge, Pittsburg	21.50	to	21.75

STEEL.—The steel market continues quiet. There has been very little inquiry during the past week and the consumers have shown no disposition to come into the market at the present prices. Despite this the market is firm and prices remain unchanged. Billets 4x4 are held at $35, and $36 is still quoted for slabs and for small billets at mill, Pittsburg, Wheeling or valley. Sheet bars are firm at $36, mill.

FERRO-MANGANESE.—Ferro continues scarce and we continue to quote $125 for domestic 80 per cent.

RAILS AND TRACK MATERIAL.—There is little inquiry for rails apart from recently noted Western business, and no changes are noted in price. Track material is unchanged also and we repeat quotations as follows: Rails, standard sections, over 200 tons, $35; 100 to 200 tons, $37; car lots, $38; less than car lots, $40; light rails, 25-pound and less than 50-pound, $37, all f. o. b. mill, Pittsburg; track material—spikes, 2.50c; track bolts square heads, 3.60c; hexagon heads, 3.85c; splice bars, 2.50c to 2.60c; links and pins, 3c to 10c.

SPELTER.—During the week there has been an increase in spelter of 15 cents. Prime western grades are held at 4.60c to 4.65c, Pittsburg.

SKELP.—Little is being placed on the market as the great-

est portion of that manufactured here has been sold in advance. Grooved iron and steel skelp is quoted at 2.15c, at mill. Sheared iron and steel skelp we quote at 2.35c to 2.40c, f. o. b., Pittsburg.

MUCK BARS.—One of the large manufacturers of muck in this district is manufacturing his whole product into skelp. We quote the best grades $30 to $31.

BARS.—With few inquiries and small sales the market for steel bars continues very firm with 2.25c the minimum in this district. There is no change in iron bars, refined being quoted at 2.40c, Ptitsburg, and common iron bars at 2.15c, valley.

STRUCTURAL MATERIAL.—The outlook for this product is one of the brightest features of the iron and steel trade at the present time. The probable placing of the contract for the structural material for the New York rapid transit tunnel with the leading steel producer opens up the year most auspiciously. While it is true that the delivery of the material will be stretched over a period of three years, it augurs well for the year at this particularly dull season. A number of producers have large contracts in view but there is no indication that they will be closed for several months. There is a steady demand for bridges, industrial plants, etc. We continue to quote the market without change as follows: Beams and channels 3 to 15 inches, 2.25c; 18 to 24 inches, 2.35c; tees 2.30c; zees 2.25c; angles, 2.25c. Universal mill plates, 2.50c to 2.75c, according to delivery and size of order.

PIPES AND TUBES.—The demand is reported very good for this season of the year. The majority of the sales are for small amounts. We quote the market unchanged as follows: Merchant pipe, 50 and two 10's for car loads delivered within the specified territory; well casing, screw and socket joint, 37½; inserted joint, 32½, with an optional 5 per cent to dealers only; boiler tubes 1¼-inch to 1½-inch, 40 per cent off; 1¾-inch to 2½-inch, 50 per cent off for iron, and 55 per cent off for steel; 2¾-inch and larger, 52½ per cent off for iron and 55 per cent off for steel, with 5 per cent additional in carloads, less than carloads being f. o. b. mill.

PLATES.—While the market showed some slight signs of increasing strength last week it is reported easier with prices varying on tank plates, the bulk of the business going at 2.40c for assorted widths. On wide plates 2.50c has been quoted while as low as 2.25c has been heard on narrower plates. We quote shell steel at 2.60c to 2.70c; flange, 2.70c to 2.80c; fire box, 3¼c to 4c.

SHEETS.—The sheet market is even firmer than a week ago and mills that have business any considerable time ahead refuse to take orders for No. 28 gauge, one pass through cold rolls, for less than 3c and 3.10c. Other sales however have been reported at our last week's quotations, namely 2.95c to 3c, for January and February. Galvanized is reported strong, with the mills quoting 75 and 5 in the majority of cases and 75 and 7½ in a very limited number. The usual 15-cent freight allowance is also given. Gossip continues concerning the consolidation. It is reported that the promotors are making excellent progress and that nearly all the smaller mills are willing to enter the combine It is known that one or two of the larger mills are holding off. Whether they refuse an option on their plant owing to their desire not to become a part of a consolidation or whether they are holding off for better terms is not known; but the belief is general that they will remain as separate organizations.

OLD MATERIAL.—There is not a very great demand for old material and owing to the rather limited supply we note only a few changes in our quotations from those of last week: Pittsburg delivery, gross tons, except where otherwise specified: New basic melting stock, $30 to $32; new Bessemer melting stock, $23.50 to $25; basic open-hearth scrap, $31 to $33; steel rails, mixed lengths, $22 to $23; short lengths, $23 50 to $24; iron rails, $29 to $31; cast borings, $14 to $15, net tons; cast scrap, $18 to $20; No. 1 wrought scrap, $24 to $25, net tons; busheling scrap, $16 to $18, net tons.

COKE.—The scarcity of coke continues and this coupled with the scarcity of cars has made the Connellsville product extremely scarce for furnace and foundry use. Small lots of furnace coke are selling at $3 and $3 50 while foundry coke is held at $3.50 to $4 for small shipments. The firing up of a number of ovens in the Connellsville region will it is believed relieve the pressure on the ovens in that region. It is understood that the large coke pile wihch the leading steel producer maintained for a number of years and which is now being removed will be replaced as soon as coke eases up.

CHICAGO.

Office of The Iron Trade Review,
1522 MONADNOCK BLOCK, Jan. 23.

Business is gradually getting to be of larger volume, and the local mill and furnace representatives express themselves as well satisfied with the volume of the trade in the past week. Demand grows larger every day, and it is expected that sales during the balance of this month and in February will be fully up to the record.

PIG IRON.—A much better demand is reported, and sales have increased to a considerable extent, also. The larger sales of the week were of Southern iron, and included several for round lots, but those of local irons were also of good size, larger than have been had before this year. Considerable complaint is heard that the supply of coke, of both furnace and foundry grades, has been and is short. Lately some of the local furnaces running on foundry irons have had to stop for a few days, because of their inability to get coke. Several foundries, too, have been obliged to make a smaller output than usual because of the coke shortage. This, it is said, is entirely due to the lack of transportation facilities, it being exceedingly difficult to get enough cars to supply the demand. The inquiries in the market at present are of good size, and it is thought a good many of them will result in orders within a very short time. Furnacemen are looking for a large business in the next month, and the indications are that their expectations will be realized. The market is very firm, furnaces making no concessions to secure business. Buyers are not asking for concessions, although some of the larger ones have put off making purchases apparently in the hope that prices will fall off to some extent. These are begining to realize, however, that the situation is full of strength, and the likelihood of lower prices in the near future is exceedingly small. Quotations are continued as follows:

Lake Sup. Charcoal	$25 50 @ $26 50	Southern Coke No. 3	$20 85 @ $21 85
Local Coke Fdy. No. 1	25 00 @ 25 50	Southern No. 1 Soft	22 85 @ 23 85
Local Coke Fdy. No. 2	24 50 @ 25 00	Southern No. 2 Soft	21 85 @ 22 85
Local Coke Fdy. No. 3	24 00 @ 24 50	Southern Silveries	26 50 @ 27 00
Local Scotch Fdy. No. 1	25 00 @ 25 50	Jackson Co. Silveries	32 00 @ 32 50
Local Scotch Fdy. No. 2	24 50 @ 25 00	Ohio Strong Softeners	24 50 @ 25 00
Local Scotch Fdy. No. 3	24 00 @ 24 50	Alabama Car Wheel	24 00 @ 26 00
Southern Coke No. 1	22 85 @ 23 85	Malleable Bessemer	25 00 @ 26 00
Southern Coke No. 2	21 85 @ 22 85	Coke Bessemer	25 00 @ 26 00

BARS.—The market has been rather quiet, not very many or very large sales having been made in the week. The demand as a rule is limited to comparatively small lots. Mills are very firm in their views, and are making no concessions from the former quotations of 2.30c to 2.45c for common iron, and 2.35c to 2.50c for steel, half extras, Chicago delivery.

RAILS AND TRACK SUPPLIES.—The local mills have made sales aggregating over 40,000 tons since the first of the year, and have inquiries in hand which will amount to as much or more, and which are expected to be closed within a few weeks, or possibly days. Chicago mills have already more tonnage sold for delivery in 1900 than ever before in the same period of the year. Of the recent sales some are for delivery in Canada, but the larger part are for home consumption. Quotations are as follows: Rails, standard sections, $35 to $38; light sections $37 to $42; splice bars, 2.50c to 2.70c; spikes, 2.75c to 2.85c; track bolts, 3.65c to 3.85c.

BILLETS AND RODS.—An inquiry has been received for a large lot of rods for foreign shipment, but the local mills are unable to take the business. A few small orders were taken in this territory last week, but none of them by the local mills. Waukegan mills of American Steel & Wire Co. are rolling rods and shipping them to the Cleveland district, to offset the shortage caused there by the striking rod mill employes. Bessemer billets are quoted at $35, and sheet bars at $36, Pittsburg, with $2 added for Chicago delivery. Open-hearth rods are quoted at $65 and Bessemer at $55 by Central Western mills.

PLATES.—Mill business last week was not large, and almost none of the tonnage placed was taken by local mills. A considerable store business in small lots was closed. The market is still inclined to be a little weak. We quote tank steel from store 3.10c to 3.20c. Mill shipments Chicago delivery: Tank steel, 2.65c to 2.70c; shell, 2.75c to 2.80c;

flange, 2.80c to 3c; marine, 3c to 3.10c; firebox, 4c to 6c, according to brand.

STRUCTURAL MATERIAL.—No large orders were closed last week, and the small order business did not make a very large aggregate. A considerable tonnage is being figured on, in lots ranging from 6,000 tons down, and it is likely that a fair proportion of it will be placed this month. Among the orders in the market are one of 6,000 tons of bridge material wanted by the C. & N. W. road; 3,500 tons required by the Rock Island, and about 1,300 tons required for a warehouse to be built by the Northwestern Universty for J. B. Clow & Son. Quotations follow: Beams, 15 inches and under, 2.40c; 18 inches and over, 2.50c; angles under three inches and over six inches, 2.50c; three inches to six inches, 2.40c; sheared plates, 2.65c to 2.75c; universal plates, 2.75c to 2.80c; tees, 2.45c; zees, 2.40c; small lots from store are quoted from ¼c to ½c higher.

SHEETS.—The demand has improved materially, and considerable sales of both small and large lots were made in the week. Among the orders placed were several long time contracts of good size. The market is firmer, and mills are not making concessions. Black sheets are quoted at 3c to 3.15c for No. 27, and galvanized at 75 to 75 and 5 per cent off.

MERCHANT STEEL.—Business is limited almost entirely to small orders for store shipment. Very few mill orders have been received. The market is very firm. Smooth finish tire steel is quoted 2.80c to 3c; smooth finish machinery steel, 2.95c to 3.05c; spring steel 3.65c to 3.75c; tool steel, 7c to 7.50c; special, 13.50c and upwards.

MERCHANT PIPE.—Business was light and was confined to comparatively small orders. Quotations are unchanged at 50, 10 and 5 off for small orders, and 50, 10 and 10 off for large orders, mill shipment.

WIRE AND WIRE NAILS.— The situation has not changed. The demand is excellent, and the business done last week was fully up to expectations. Quotations are firm and unchanged. Makers quote single carloads of wire nails at $3.53, f. o. b. Chicago, and $3.63 for less than carloads. On wire, current quotations are as follows: Plain annealed wire, $3.38; painted barb wire, $3.98; galvanized barb wire, $4.13.

OLD MATERIAL.—There is considerable demand for some grades of scrap, while others are dull, with only small sales. Old iron rails are not wanted and prices are inclined to be weak. Steel rails are in somewhat better demand, while old wheels are selling well at somewhat higher prices. Other grades are quiet and unchanged. Dealers' selling prices are about as follows:

Old iron rails, gross,	$26 00@$27 00	Country malleable	$14 50
Old steel rails, long, gr.	23 50@ 24 00	Iron axles, net	$28 00@29 00
Old steel rails, mixed	19 50@ 20 00	Cast borings, net	10 00@11 00
Relaying rails, gross	28 00@ 30 00	Wrought turnings, net	11 00@12 00
Old wheels, gross	23 50@ 24 50	Iron axle turnings, net	14 00@15 00
Railroad forge, net	24 00	Steel axle turnings	12 00@12 50
Dealer's forge, net	16 50@ 17 00	Mixed country steel, gr	15 00
No. 1 cut mill, net	14 00	Stove plates, net	10 00@10 50
Heavy cast, net	14 50@ 15 00	Heavy melting steel, gr	19 00@19 50
Railway malleable, net	16 00	Old iron splice b., net	26 00

The Minerva Pig Iron Co., of Milwaukee, Wis., whose product is strong foundry pig iron, is now its own selling agents. The company will sell all grades of pig iron, either by fracture or by analysis regardless of fracture, as the buyer may elect when ordering.

CLEVELAND.

OFFICE OF *The Iron Trade Review*,
27 VINCENT ST., Jan. 24.

There is the sort of ore buying often seen in summer months—the picking up of lots by the more deliberate buyers who have taken time to canvass their wants and get the drift of things in the general iron market. In the past week a number of sales ranging from 5,000 to 15,000 tons have been made, and other inquiries, involving amounts as high as 25,000 tons are pending. This activity is taken to indicate a belief by furnacemen that the present basis on their product will be held substantially through the year, and that in order to get the ores they want in the quantities desired for their mixtures early action is safest. Strictly Bessemer ores from old ranges are now quite well taken up, as are the bulk of the choicest Mesabis. There remains unsold, however, a large aggregate of miscellaneous ores, of the 1900 product, and a corresponding estimated production of furnaces using Lake Superior ores is unprovided for as yet.

PIG IRON.—There is still inquiry for Bessemer for delivery in the first half of the year, and some minor sales are reported in the past week on the $24 basis at valley furnace. As indicating the close connection between maker and consumer of pig iron now being made, the official statistics of unsold stocks Dec. 31 are interesting. In Allegheny county, the two valleys and the Cleveland district the total was 1,712 tons. The inquiry for foundry iron in the week has not been important and buying may be postponed for a few weeks longer, with a prospect that when it comes there will be a good many consumers in the market at once. They are not yet fully persuaded that prices will not be lower and are hoping that the wait will break them. On sellers' part it is a firm wait, so far, and producers gather from the way in which iron on contracts is called for that consumption is rather growing than otherwise. There has been some inquiry for Southern forge, which is delivered at about $20.50 at valley mill, and seems to be increasingly in use, in the scarcity of Northern brands. Valley furnaces ask $21.50 for gray forge and some business has been done on that basis. We quote:

Bessemer	$24 50	Valley Scotch No. 1	$23 00@23 50
No. 1 Strong Foundry	23 00@ 23 50	Valley Scotch No. 2	22 50@23 00
No. 2 Strong Foundry	22 50@ 23 00	Gray Forge, valley	21 50
No. 3 Foundry	21 50@ 22 00	Lake Superior Charcoal	25 00@26 00

FINISHED MATERIAL.—Locally there are no signs of weakness in mill products. Business in the week has been better than expectations, a steady run of specifications and of new small orders coming in from a varied trade, showing that consumers are busy and are getting their prices easily. In bar iron and steel bars no large contracts have been closed but there is known to be a large tonnage hanging over the market, waiting for buyers to make up their minds. We still quote steel bars at 2.25c, Pittsburg and common bar iron at 2.15c, valley mill, with additions for cutting and for assorted sizes. Plates have been quiet, with 2.40c for tank and assorted widths generally maintained by Pittsburg mills. Another 3,000-ton vessel, Welland Canal size, is soon to be placed, and there are indications that the lake shipyards will be occupied through the year. The outlook for a good spring demand for wrought pipe is reported good, and meantime prices hold very firm under January quietness. Sheet mills are not making the concessions heard of three or four weeks ago, and as indicating that some of them are preparing to quote on further forward deliveries, an inquiry for 5,000 tons of sheet bars for delivery in second and third quarters is noted. On No. 28 sheets deliveries running through February we quote 3c, Pittsburg. Beams and channels are locally quiet, but the mills are filling up, and the tendency is to a firmer market, with a prospect that deliveries may not be obtainable as buyers desire, when the active season opens. We quote 2.25c, Pittsburg mill, on beams and channels.

OLD MATERIAL.—The demand is only moderate, and on the other hand there is little pressure to sell. Steel melting stock is probably the firmest department of the market. We quote machinery cast scrap, $17 to $18; No. 1 railroad wrought, $23.50 to $24; wrought turnings, $14; cast borings, $12.50 to $13; busheling scrap, $16.50 to $17; old steel rails, $21 to $22.

WIRE AND WIRE NAILS.—Local rod mills apart from continuous mills are shut down by the union rod mill workers' strike, but material is being received from outside plants. Jobbers' orders show expectation of a large spring trade in wire nails. Buying in plain and barb wire is of good proportions. We quote wire nails at $3.35, Pittsburg mill, in carload lots to retailers and $3.20 in carload lots to jobbers; smooth wire, $3.20 in carload lots to retailers, and $3.05 to jobbers; barb wire, $3.65 for painted, and $3.80 for galvanized to jobbers, with 15c advance to retailers. To these prices freight to Cleveland is to be added.

CINCINNATI.

Jan. 23.

The scarcity of malleable grades of iron is still in evidence, both in charcoal and coke irons. A somewhat urgent demand also appears for car wheel irons. While there is a continuous call for foundry irons in small lots, no big business has developed yet for the middle and third quarter of the year. Rogers, Brown & Co. say: "The improvement and demand in sales noted last week has been somewhat emphasized this week in increased inquiries and a larger volume of business. Orders for carloads and small lots, quick shipment, are numerous and embrace every class of iron, evidencing the continuance of the activity in the general foundry trade and the manufactories. The Southern furnaces and the Virginia coke ovens

are recovering from the demoralization occasioned by the holiday hilarities of the operatives, and much needed shipments of iron and coke are coming forward more freely, though as yet in insufficient tonnage to satisfy consumers. There is no special feature other than already mentioned marking the transactions of the week."

Matthew Addy & Co., in their review of the situation in Southern irons say: "We awe getting along now pretty well toward the end of the month, and January has not been a record breaker by any means, but business has been getting better right along during the month. It was dull enough at the start, and while it is not tremendously active now, yet it has been progressively brisker. There is a number of excellent inquiries for foundry iron in the market at the present time. There is alo a number of inquiries for forge iron, and there has been a good deal of forge iron wanted for quick shipment, which it has been impossible to obtain. In the way of soft irons there is at the present time a genuine shortage. All of the Southern furnaces had sold large quantities of iron for shipment beginning January and almost without exception there has been trouble in sending forward on the soft foundry orders the full quota called for this month by the contracts. There is no denying the fact that iron is just as scarce today as it has been at any time and any buyer who came into the market attempting to buy 5,000 tons of scattered foundry grades of Southern iron for shipment during the next 60 days would find that he was trying to do something that we believe is impossible. There has been some little re-selling of contracts of consumers who bought in excess of their wants, but there is scarcely enough of this to mention."

We quote for cash f. o. b. Cincinnati: Southern coke No. 1 foundry, $21.75 to $22.25; Southern coke No. 2 foundry, $20.75 to $21.25; No. 3 foundry, $19.75 to $20.25; No. 4 and gray forge, $19.25 to $19.75; No. 1 soft, $21.75 to $22.25; No. 2 soft, $20.75 to $21.25; Lake Superior coke, No. 1, $24 to $24.50; No. 2, $23.50 to $24; Hanging Rock charcoal, No. 1, $25 to $26; Jackson county silvery, No. 1, $30 to $31; standard Georgia car wheel, $24.75 to $26.25; Lake Superior charcoal, $25.50 to $26.50.

PHILADELPHIA.

Jan. 23.

The steadiness of the market is still its prominent feature. The expectation, or more exactly, the hope of buyers that there will be an easing off of prices is apparent in the waiting attitude of most of them. The supposition has been with many who have watched the market closely for two months, that when there was no advance, a decline would be only a matter of a little time. The reports current of a concession of 25 to 50 cents in the case of a large buyer of foundry iron have been interpreted on the one hand as proof that one large consumer at least was convinced that iron at any concession, even as small as that named, was a purchase and that indications did not favor a slump. Another use made of the matter has been seen in the general intimations given in some quarters that there are soft spots, and that in time the preponderance of production will appear more clearly. There is, in fact, no indication that higher prices will be asked in the near future. At the same time sellers are quite firm as a rule, in maintaining present quotations for pig iron. Consumption keeps up so well that it would seem that buyers will be the first to terminate the quiet time. They may not buy on as large a scale as last year, and small and moderate lot purchases may be the general rule for some time. But the possibility is not overlooked, at the same time, that the coming season may bring large activity and strain the ability of the furnaces, under the existing condition of short fuel supply. There has been some inquiry for foundry and forge irons the past week and one inquiry for 8,000 tons of gray forge, delivery in the first quarter, has been reported. The difficulty of securing this delivery on so large a lot has been made apparent. We quote No. 1 foundry at $25 and $25.50; No. 2X foundry, $23.25 and $24.25; No. 2 plain, $22.25 and $22.75; gray forge $20.50 and $21. Muck bar is unchanged at $30 and $30.50, seller's mill. Steel billets are very dull. While makers are uniform in their prices, and some small sales are made at $37, buyers contend for a lower figure, and the wait continues. Present ideas of buyers are in the neighborhood of $35 as a basis on which some business might be done. The volume of finished material keeps up, but irregularities are still seen, due to the efforts of some mills to get business. Plates are not generally stronger, though some mills represent that they are not quoting the low prices reported recently. We quote tank plate at 2.40c and 2.50c. The mills recently started are making rather more than the usual effort to get business. Bars show more strength and the average quotation is about $1 a ton higher than at the opening of the year. We quote best refined iron at 2.10c and 2.20c, delivered; sheets No. 27, 3.10c; beams and channels, 2.40c and upwards. On old material bids and offers are about as follows: Choice railroad scrap, $22 and $25; No. 1 yard scrap, $19 and $20; No 2 light scrap, $13 and $14; machinery cast, $17.50 and $18.50; heavy steel scrap, $20 and $21; old iron rails, $26 and $28; old steel rails, $21.50 and $22; wrought turnings, $15 and $15.25; cast boring, $13 50 and $14; old car wheels, $21 and $22; iron axles, $28 and $30; steel axles, $28 and $30.

PITTSBURG FOUNDRYMEN'S ASSOCIATION.

Car wheel manufacture was discussed at length at the meeting of the Pittsburg Foundrymen's Association Monday evening, Jan. 22. Mr. A V. Slocum was scheduled to read a paper entitled "Comparative Wheel Making," but owing to a sudden illness could not prepare the article and was unable to attend the meeting. His brother, Mr. C. V. Slocum, formerly secretary of the Pennsylvania Car Wheel Co, now controlled by the Pressed Steel Car Co., volunteered to fill the gap and gave an interesting address on car wheel foundry operations.

The severity of the tests to which the car wheels are put by the railroad companies before they are accepted was explained. He stated that the wheels are tested in lots of 103, three wheels of each lot being set aside for the purpose of being tested by the inspectors for the railroad companies. From each heat a standard test bar is secured and several other test pieces are also made. The test pieces are 1¼ or 1½ inches thick by 2 inches wide and 6 inches long, and are cast with the 2x6-inch face against the chill. The bar is given a transverse test and in many cases showed more than 4,000 pounds. The test pieces are examined for depth of chill, etc.

The three wheels are next tested. They are picked at random from the lot. One wheel is selected for the drop test. The hammer weighs 140 pounds and drops a distance of 12 feet. It trips automatically and the wheel must stand ten blows before being broken in two, or the entire lot of wheels is rejected. If the wheel is not broken in two with ten blows it is hammered until broken. The depth of the chill on the broken parts of the wheel is then measured, and the metal examined to see whether it meets with the specifications. The other two wheels are then given the thermal test. The wheels are laid in sand and molten metal is poured against the flanges and treads. The wheels must withstand successfully the expansion of the metal and if they crack through the flange or tread in less than two minutes the entire lot of wheels is rejected. If the wheels stand this test they are taken to a drop, broken and again examined for the depth of chill, thickness of plates, general quality of iron and other tests. The entire lot of wheels is carefully examined by the inspectors for every visible defect, such as the thickness or thinness of flange, pin head bubbles, etc. If any wheels are found that have these defects they are thrown out, but their rejection does not necessarily affect the entire lot of wheels. Mr. Slocum added that the car wheel manufacturer must guarantee the wheels that pass inspection, for freight service for five years or to run 70,000 miles. If the wheel does not hold out this length of time it must be replaced by the manufacturer. If it can be proved that the wheels are slidded, flat or burned, the manufacturer cannot be compelled to replace them.

The speaker was asked whether other than charcoal iron had not proved satisfactory in the manufacture of car wheels. He replied that other irons have proved satisfactory in many respects but do not give the chilling quality. Titanium has been used in the mixture and in some instances steel, while in others coke iron has proved successful. If coke iron can be used successfully in the manufacture of wheels it would be much cheaper than the charcoal iron. The trouble with the coke iron, he explained, was that it did not give the depth of

chill required by the specifications of most railroad companies and was not used very extensively for that reason.

He mentioned molybdenum as one of the metals that had been used with some success in metal mixtures for car wheels, but its cost was so high as practically to prohibit its use for this purpose.

Mr. Slocum was then asked at what temperature car wheels were poured. He stated that the metal was poured as hot as possible and as it takes from 10 to 13 seconds to make a cast, there would be practically a uniform chill. The chills are coated every cast with a mixture of varnish and shellac. This gives the tread a fine texture and lengthens the life of the chills. Two wheels cannot be made in one day with the same molds for the reason that they must be allowed to cool before being used again. After the wheels are cast they are placed in annealing pits where they remain for from four to five days. Slow or rapid cooling, however, has no effect on the chill.

The different sizes of chills have been an eye sore for years to the car wheel manufacturer, said Mr. Slocum. The master car builders, however, are getting together in the matter of chills, and the chief annoyance at present is from the street railways. The latter do not require as severe a test as the steam roads, but demand that the wheel be guaranteed for from eight to 18 months. Street car wheels wear out more quickly than those of steam roads, partly because the motormen are so careless about skidding the wheels, and further because they are much lighter than those used for steam roads. The price of wheels then came up for discussion and it was stated that old wheels bring more at present than new ones one year ago.

The manufacture of chilled iron wheels in Europe was next touched upon. In Austro-Hungary, Mr. Slocum stated, chilled iron wheels have been manufactured in recent years, the plant being constructed by American engineers. In France a foundry was erected last year and one is to be built in England very soon. The initiative in the use of chilled iron, however, is from this country. The wheels extensively used in Europe at present are of wrought iron and are welded together by hand. It requires 1 000 men to make 200 wheels per day by this process, while with chilled cast iron the same number of wheels can be made by less than 100 men.

Regarding the so-called paper wheel Mr. Slocum said that its use was very limited. The rim is steel, and the hub is of iron. The center outside of the hub is of papier mache. Less than 10 per cent of the car wheels now in use are of this type.

At the business session of the association it was decided to amend the by-laws by changing the date of meeting from the fourth Monday in the month to the first Wednesday. This is in accordance with the movement among the various local organizations affiliated with the American Foundrymen's Association, to meet on the same night each month and to have the same papers read before each body the same evening. Secretary Zimmers reported nothing new with reference to the annual convention. At a previous meeting the association had expressed a preference for Boston. The next meeting will be held Wednesday, Feb 7. A smoker and entertainment will be arranged. Dr. R. G. G. Moldenke presided Monday evening and there were about 30 foundrymen present.

Causes of Hardness in a Casting.

To the Editor:

In your issue of Jan. 18, page 11, in Mr. Edward Kirk's article on "Chemistry and the Foundry," is the statement: "Hardness in a casting is due to the iron, wet molding sand," etc. This idea that wet sand causes hard castings is a delusion—a shield to get behind, when bad mixtures are responsible. I have tests in my possession made from time to time, that go to prove that the statement is erroneous. My claim is that if the iron is put to the melting point and sent through without chilling on the way to the bed, and the mixture is right, it can be run through water or over ice and the result will be right. Wet sand and water swabbing cut no figure I should like some light on the cause of hard iron when the mixture is right.

W. M. Spera.

Columbia, Pa.

Harry R. Hall is now superintendent of Middlesbrough, (Ky.) Furnaces of the Virginia Iron, Coal & Coke Co., one of which is in blast, while the other will probably start about March 1.

PERSONAL.

Joseph Chamberlain, Secretary of State for the Colonies, announced at a meeting at Birmingham, Eng., Jan. 18, that Andrew Carnegie had given anonymously $500,000 for the Birmingham University project.

William H. Latshaw, first assistant treasurer of the National Tube Co., has been elected a director to fill the vacancy caused by the recent death of Capt. J. J. Vandergrift.

Edwin S. Mills, Cleveland manager of the Carnegie Steel Co. and Oliver Iron Mining Co. interests, was elected a member of the board of managers of the Lake Carriers' Association at the annual meeting at Detroit last week.

Col. M. Barhatkin, inspector of armor plate for the Russian navy at the Homestead plant of the Carnegie Steel Co., and his private secretary, A. Knaap, had as their guests last week four prominent officials of their navy. They were Col. A. Brynk, chief of the Russian board of special armor plate inspection; J. Wencelidesh, a member of the board and Lieutenants P. Macedinsug and O. Risher, who are stationed at the Cramp shipyards at Philadelphia. They inspected the Homestead plant and expressed astonishment at the magnitude of the works and the many labor saving devices. The Westinghouse plants at East Pittsburg were also visited.

David F. Geissinger succeeded C. G. Smith as auditor of the U. Baird Machinery Co., Pittsburg, the first of the year. Thomas T. Collins, has been placed in charge of the small tool department.

Peter McCool, superintendent of the Woods Run plant of the Pressed Steel Car Co., left last week for Europe. It is said that his visit to the old world is for the purpose of making observations with reference to increasing the company's business on the other side of the Atlantic.

Edwin H. Herr has been appointed assistant general manager of the Westinghouse Air Brake Co. John F. Miller has been made assistant secretary.

F. T. F. Lovejoy resigned as secretary of the Carnegie Steel Co., Jan. 17, and A. M. Moreland, who has been auditor and assistant secretary was chosen to succeed him. Mr. Lovejoy had been connected with the company for 19 years, and was secretary for 11 years. No announcement has been made as to Mr. Lovejoy's successor on the board of managers of the company.

Stewart H. Chisholm formerly president of the HP. Nail Co., Cleveland, and now a director of the American Steel & Wire Co., was married at New York, Jan. 23, to Mrs. H. P. Card, of Cleveland. Mr. and Mrs. Chisholm will go to Europe for a three months' stay.

Edward N. Moore, of Youngstown, formerly superintendent of the mills of the Andrews Bros. Co., at Haselton, O., has been appointed superintendent of the mills of the American Iron & Steel Co., at Lebanon, Pa.

G. S. Barber, who has been connected with the civil engineering department of the Champion mine on the Marquette range for several years, has gone to the Gogebic range to take charge of the Mikado mine.

Francis L. Robbins, president, and J. W. Blower, superintendent of the Redstone Division of the Pittsburg Coal Co., and Capt. W. A. Rodgers and D B. Blackburn, of the Monongahela Consolidated Coal & Coke Co., Pittsburg, attended the inter-State convention of operators and miners at Indianapolis this week.

S. T. Wellman, of the Wellman-Seaver Engineering Co., and Ambrose Swasey, of Warner & Swasey, sailed from New York this week for a European stay of several months.

Geo. M. Laughlin, of Jones & Laughlins, has been elected president of the Keystone Bank, Pittsburg, succeeding the late Capt. J. J. Vandergrift.

James B. Oliver, president of the Oliver Iron & Steel Co., sailed for Europe this week.

C. P. Wheeler, of Pickands, Brown & Co., Chicago, leaves Jan. 27 for a two months' trip abroad. Mr. Wheeler will sail direct to Italy, and later will visit other European countries.

In the changes in the Lorain Steel Co. organization resulting from the resignation of President Moxham, to become general manager of the Dominion Iron & Steel Co., at Sydney, N. S., Daniel Coolidge, heretofore vice-president was made president. Max M. Suppes was made vice-president and general manager. F. W. Saltmarsh, treasurer, who resigned to become identified with Mr. Moxham's organization at Sydney, is succeeded, as already announced, by Alfred C. Gary, of Chicago.

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AND
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JANUARY 25, 1900.

STEEL CONTRACT FOR RAPID TRANSIT TUNNEL.

(Special Telegram.)

NEW YORK, Jan. 24.—There is little doubt that the Carnegie Steel Co., Ltd., will secure the contract for furnishing the steel to be used in the construction of the Rapid Transit tunnel. While it is understood that the contract has not yet been closed it is considered almost a certainty that when John B. McDonald, the successful bidder on the work, closes with the sub-contractors it will be found that the Carnegie Steel Co. will get the steel construction. The contract calls for 72,945 net tons of material which together with cost of construction will average about $60 a ton. Bids were received on seven sub-divisions of the iron and steel work. The material is divided into four classes, namely, steel beams, riveted beams, viaduct work and cast iron. The distribution follows:

	Steel Beams	Riveted Beams	Viaduct Work	Cast Iron
Section 1	11,660	11,660	. .	1,093
Section 2, E.	1,963	959	. .	110
Section 2, W.	6,177	6,458	2,100	377
Section 3, E	991	459	. .	6 255
Section 3, W.	838	367	. .	66
Section 4, E.	100	44	11,580	. .
Section 4, W.		. .	9,488	. .
Totals, net tons	21,729	20,147	23,168	7,901

Provided the contract is closed, the Keystone Bridge Co. will do the fitting and the work of erection. Deliveries are to begin in February and will extend over the three years following.

Wheeling District Works of National Steel Co.

With the opening of the new year the business of the Aetna-Standard Iron & Steel Co., Bridgeport, O., and that of the Bellaire Steel Co., Bellaire, O., were taken over by the National Steel Co. In both cases the acquisition of the properties by the National Steel Co. in February of last year was by purchase of all the stock of both. However, the identity of the companies was maintained, and each had its own officers. On Jan. 1, B. M. Caldwell, who had been vice-president and general manager of the Aetna Standard Iron & Steel Co., resigned, as did also J. J. Holloway, for a number of years treasurer of the company. Mr. Caldwell, though solicited to remain in the business, and as well to make other connections, proposes to take a rest, and will leave shortly for Cuba, the Bahamas, and Puerto Rico. It is announced in a circular issued by the Aetna-Standard Iron & Steel Co., that that plant will be known as the Aetna-Standard Works, National Steel Co., the whole business being in charge of John A. Topping as manager. However, the old company, of which Mr. Topping is president, maintains its identity. The Bellaire Steel Co. was taken over by the National Steel Co. in the same way on Jan. 1 and its plant will be known as the "Bellaire Works, National Steel Co.," with A. B. Carter as manager.

LAKE SUPERIOR IRON MINES.

Reports are again in circulation that the Atlantic mine on the Gogebic range has been sold by Mr. Frank Rockefeller, but statements disagree as to the purchaser, two large steel producers being mentioned. We are informed that while negotiations are in progress, a sale has not been closed as yet.

The stockholders of the Republic Iron Co. held their annual meeting last week in the company's offices in Cleveland and reëlected the old directors as follows: H. B. Perkins, G. W. R. Matteson, Samuel Mather, Peter White, J. V. Painter, W. D. Rees, N. H. Kauffman, A. Hart and W. F. Dummer. The directors organized as follows: President, W. D. Rees; vice-president, Samuel Mather; secretary, W. B. Castle.

The Pioneer Iron Co., a connected interest of the Cleveland-Cliffs Iron Co., is exploring the ore lands of the Negaunee Iron Co. The Pioneer Iron Co. some time ago acquired the Carp Furnace at Marquette, and it is now seeking ore under an old lease giving it the right to enter upon lands of the Negaunee Iron Co. and mine, royalty free, such ores as it smelts in its own furnaces in Marquette county. The Breitung estate, which controls the Negaunee Iron Co., has asked, in addition to royalties, a one-third interest in mines developed on the company's lands. It has contended that there are provisions in the original contract with the Pioneer Iron Co. by which the free ore arrangement is now inoperative, and a legal contest is expected, but thus far the operations of the Pioneer Iron Co. have not been interfered with.

Recent contest over the Monongahela mine, adjoining the Columbia in the Crystal Falls district, has been settled and it goes to Oglebay, Norton & Co., of Cleveland. A boiler and hoist will be installed. Some years ago two shafts were sunk 70 feet and considerable drifting was done.

Corrigan, McKinney & Co., of Cleveland, who recently purchased the Ropes gold mine northwest of Ishpeming, Mich., are taking some of the machinery to their iron mines in the Crystal Falls and other districts. Something may be done later at the Ropes.

R. D. Nuttall Co. Expansion.

[Special Telegram.]

PITTSBURG, Jan. 24.—R. D. Nuttall Co., of Allegheny, the well-known gear manufacturing concern, will concentrate its plant in the plant in this city formerly occupied by the Westinghouse interests. Contracts have been given for $50,000 worth of new equipment. Two 125 h. p. gas engines will be installed.

Better Chance For the Bridge Consolidation.

J. Gifford Ladd, of New York, who has been working on a combination of bridge companies for the past year, was in conference with a number of bridge manufacturers in Pittsburg last week. The Pittsburg district was fully represented, as were the East and the West. Although the consolidation was not consummated at this meeting it is said that those directly interested were almost unanimous in favoring the plan of proceedure outlined. According to the new plans the consolidation is to be capitalized at $32,000,000 instead of $65,000,000 as was previously suggested. Furthermore, little or no cash will be required, all the companies receiving stock in the new one in proportion to their business and the value of their respective plants. Another meeting is to be held in New York within a few days when it is believed the details will be arranged. The saving in the expense of selling is expected to be very large, this being a prominent item in the cost of competitive bridge building, particularly on public work. The American Bridge Co is the name likely to be chosen.

IN October, Rogers, Brown & Co. offered $50 to the person sending to them in that month an estimate of pig iron production in the United States in 1899 that should prove to be nearest to the official figures. Publication of the latter is made this week and it is found that the estimate sent in by S. M. Pagan, of Philadelphia, is nearest the actuals.

13,620,703 Tons of Pig Iron in 1899.

The statistics of pig iron production in 1899 furnish a new record, as did those of 1898. As gathered by General Manager Swank for the American Iron and Steel Association, the figures show that 13,620,703 tons of pig iron was produced in the United States last year. Interesting details appear in the tables below, as prepared for the Feb. 1 issue of the *Bulletin*.

While in 1898, the two half year periods showed a very close approximation in output, the returns for 1899 emphasize the opposite condition. In the first half the production was 6,289,167 tons; in the second half, 7,331,536 tons, or an increase of more than 1,000,000 tons. The output last year exceeded that of 1898 (11,773,934 tons) by 1,846,769 tons, or 15.7 per cent; while the output of 1898 exceeded that of 1897 by very nearly 22 per cent. The comparison in production in the first half and the second half of the past five years as shown below is interesting:

Periods.	1895.	1896.	1897.	1898.	1899.
First half	4,087,558	4,976,236	4,403,476	5,869,703	6,289,167
Second half	5,358,750	3,646,891	5,249,204	5,904,231	7,331,536
Total	9,446,308	8,623,127	9,652,680	11,773,934	13,620,703

The production of pig iron by states and the furnaces in blast and those out of blast at the close of 1898 are shown in the following table. On Dec. 31, 1899, there were 289 furnaces in blast (these figures evidently including the Alabama furnaces that were banked in holiday week) as against 202 furnacees active at the close of 1898:

TOTAL PRODUCTION OF PIG IRON.

States.	Blast Furnaces. In blast June 30, '99	Blast Furnaces. Dec. 31, 1899. In	Out	Total	Production. Gross tons of 2,240 lbs. (Includes spiegeleisen.) First half of 1899.	Second half of 1899.	Total for 1899.
Massachusetts	.....	1	2	3	978	1,498	2,476
Connecticut	2	2	2	4	4,390	5,739	10,129
New York	6	8	12	20	96,869	167,477	264,346
New Jersey	5	7	5	12	57,930	69,668	127,598
Pennsylvania	102	119	39	158	3,047,998	3,510,880	6,558,878
Maryland	2	5	3	8	101,715	132,762	234,477
Virginia	12	17	9	26	163,896	201,595	365,491
North Carolina	1	1	1	2	3,397	14,438	17,835
Georgia	1	1	4	5			
Alabama	25	28	17	45	517,087	566,818	1,083,905
Texas	.....	2	2	4	3,643	2,160	5,803
West Virginia	3	3	.....	3	98,138	89,720	187,858
Kentucky	5	4	5	9	54,020	64,999	119,019
Tennessee	11	13	6	19	142,137	204,029	346,166
Ohio	36	45	9	54	1,075,033	1,303,179	2,378,212
Illinois	14	16	1	17	705,623	736,389	1,442,012
Michigan	6	7	6	13	65,117	69,326	134,443
Wisconsin	5	6	.....	6	83,357	119,818	203,175
Minnesota	.....	1	.....	1			
Missouri	2	2	.....	2	67,839	71,041	138,880
Colorado	2	1	1	2			
Oregon	.....	.....	1	1	.....	.....	.....
Total, 1899	240	289	125	414	6,289,167	7,331,536	13,620,703
Total, 1898	183	202	212	414	5,869,703	5,904,231	11,773,934

Production according to fuel in 1899 is shown in the table below. It also gives the unsold stocks in the hands of makers, according to fuel, at the end of the four half years terminating June 31, 1898; Dec. 31, 1898; June 30, 1899, and Dec. 31, 1899:

UNSOLD STOCKS AND PRODUCTION ACCORDING TO FUEL.

Fuel.	Stocks Unsold Gross tons of 2,240 lbs. June 30, 1898.	Dec. 31, 1898.	June 30, 1899.	Dec. 31, 1899.	Production. Gross tons of 2,240 lbs. (Includes spiegeleisen.) First half of 1899.	Second half of 1899.	Total for 1899.
Bituminous	289,232	115,615	35,571	28,217	5,478,645	6,257,730	11,736,385
Anthracite	123,848	83,976	17,527	23,419	682,027	917,525	1,599,552
Charcoal	158,497	91,642	28,122	11,793	128,485	156,281	284,766
Total	571,577	291,233	81,220	63,429	6,289,167	7,331,536	13,620,703

It will be understood that the production of "anthracite" iron, as indicated in the above is almost entirely iron made by using mixed anthracite and coke as fuel, the amount of iron now made in the United States by the use of unmixed anthracite being exceedingly small.

The stocks of pig iron shown in the table above represent only pig iron which was unsold in the hands of manufacturers or which was under their control in warrant yards or elsewhere on the dates mentioned. The reduction of stocks in the year, as is well known, was marked. The total shown on Dec. 31, 1899, was 63,429 tons. The American Pig Iron Storage Warrant Company held in its yards on Dec. 31, 1899, 4,900 gross tons of pig iron, the largest part of which was in the South. Of this total 20 tons are included in the above tables as being still controlled by the makers, leaving 4,880 gross tons of pig iron in other hands, much the larger part being in Alabama. The distribution of unsold stocks at the end of the last four half-year periods is shown in the following:

TOTAL STOCKS OF UNSOLD PIG IRON.

States.	Gross Tons of 2,240 lbs. June 30, 1898.	Dec. 31, 1898.	June 30, 1899.	Dec. 31, 1899.
New England	5,576	4,339	2,629	1,199
New York	27,322	25,005	12,619	13,229
New Jersey	10,525	1,853	.....	330
Pennsylvania	196,599	108,805	19,052	22,090
Maryland	1,475	2,422	883	.....
Virginia	35,825	18,882	5,578	6,979
North Carolina, Georgia and Texas	15,491	14,366	2,226	179
Alabama	68,229	27,166	12,177	7,262
Kentucky	12,368	5,545	2,591	1,302
Tennessee	28,099	24,389	5,989	3,259
Ohio	62,554	28,910	11,379	4,628
Michigan, Indiana and Minnesota	71,604	24,598	6,097	2,952
Illinois and Wisconsin	35,919	5,053		
Missouri and Colorado				
Pacific States				
Total	571,577	291,233	81,220	63,429

STOCKS OF PIG IRON IN PENNSYLVANIA AND OHIO.

Pennsylvania.	Lehigh Valley	45,298	27,949	5,900	372
	Schuylkill Valley	22,676	9,926	1,500	3,851
	Upper Susquehanna Valley	.....	.....	.....	285
	Lower Susquehanna Valley	25,846	26,076	450	8,731
	Juniata Valley	497	8,533	609	3,538
	Allegheny County	12,931	1,246	1,952	.....
	Shenango Valley	58,836	27,583	846	.....
	Miscellaneous bituminous	23,393	100	1,215	1,287
	Charcoal	7,212	7,392	6,580	4,026
Ohio.	Mahoning Valley bituminous	38,567	15,070	6,604	1,712
	Hocking Valley "	500	1,150	.....	100
	Lake Counties "	5,627	.....	.....	.....
	Miscellaneous "	901	1,891	1,897	833
	Hanging Rock "	8,577	5,900	1,590	1,356
	Hanging Rock charcoal	8,382	4,899	1,288	627

The production of Bessemer iron in 1899 was 8,202,778 tons, as against 7,337,384 tons in 1898, an increase of 865,394 tons. In 1897 the production of Bessemer iron was 5,795,584 tons; in 1896 it was 4,654,955 tons, and in 1895 it was 5,623,695 tons. The tables following show the production of Bessemer in 1899 by States, and in the case of Pennsylvania and Ohio, by districts; also the production of basic iron:

PRODUCTION OF BESSEMER PIG IRON.

States.	Production. Gross tons of 2,240 lbs (includes spiegeleisen.) First half of 1899.	Second half of 1899.	Total for 1899.
New Jersey	.....	13,984	13,984
Pennsylvania	2,113,418	2,360,075	4,473,493
Maryland	93,749	116,921	210,670
West Virginia	95,138	89,720	187,858
Kentucky and Tennessee	.....	22,756	22,756
Ohio	787,971	1,064,994	1,852,965
Illinois	642,528	687,641	1,330,169
Michigan, Wisconsin, and Minn	5,357	9,162	14,519
Missouri	47,746	48,618	96,364
Colorado			
Total	3,788,907	4,413,871	8,202,778

PRODUCTION OF BESSEMER PIG IRON IN PENNSYLVANIA AND OHIO DISTRICTS

Pennsylvania.	Lehigh Valley	15,308	51,795	67,103
	Schuylkill Valley	28,124	51,997	80,121
	Upper Susquehanna Valley	77,438	82,115	159,553
	Lower Susquehanna Valley	199,264	224,093	423,357
	Juniata Valley			
	Allegheny County	1,247,263	1,334,808	2,582,071
	Shenango Valley	351,203	391,219	742,422
	Miscellaneous bituminous	194,818	224,048	418,866
Ohio.	Mahoning Valley	271,828	361,735	633,563
	Hocking Valley			
	Lake Counties	166,704	264,365	431,055
	Hanging Rock bituminous	21,940	60,026	81,966
	Miscellaneous bituminous	327,499	378,878	706,377

PRODUCTION OF BASIC PIG IRON.

Pennsylvania—Allegheny county	230,109	240,739	470,848
Other counties	138,771	138,989	267,760
Maryland, Virginia and Alabama	82,377	83,716	166,093
Ohio, Illinois, Wisconsin and Missouri	41,132	39,200	80,332
Total, 1899	482,389	502,644	985,033
Total, 1898	337,485	447,959	785,444

THE IRON AND STEEL STOCK MARKET.

Denison, Prior & Co. say in their weekly letter on the iron and steel stocks: "The market at present is a very tiresome affair. Its fluctuations are fractional and unimportant, and reflect nothing but the trader's passing fancy. Reports of earnings continue to show the effects of prosperity. The Tennessee Coal, Iron & Railroad Co., for instance, makes an increase of $228,531 in its surplus for December after deducting all charges. There is some talk of a dividend of 2½ per cent being declared on Federal Steel common at the meeting of the directors to be held on Feb. 13, and as a consequence of this belief there is said to have been considerable buying of the stock by the Flower Brothers and other inside interests. Dividend rumors regarding National Steel common are also going the rounds, but without any official sanction. The money market continues easy but without feature.

"The entire stock market is awaiting news from South Africa and no movements of importance can be looked for until something definite is heard from that quarter."

Fluctuations of the Week and the Year.

The table below shows the changes in the iron and steel stocks in the week ending Jan. 22, also the high and low points for the year:

Name.	WEEK.				YEAR.					
	Open	High	Low	Close	High.			Low.		
Am. Car & Fdy.....	12⅜	13¼	12¾	13	14¾	Jan.	4	12½	Jan.	15
Am. Car & Fdy pr.	60	60½	59⅞	60½	62½	Jan.	4	59½	Jan.	2
Am. Steel & Wire..	47⅛	48⅜	45¾	48	50⅜	Jan.	2	45¾	Jan.	15
AmSteel & Wire pr	90⅜	90½	89	90½	92⅛	Jan.	3	89	Jan.	15
Am. Steel Hoop.....	41⅝	42	41⅛	42	45	Jan.	3	41½	Jan.	17
Am. Steel Hoop pr	81	81½	81	81	83	Jan.	2	81	Jan.	10
Am. Tin Plate.....	29½	30½	28⅜	29⅛	34½	Jan.	3	28⅜	Jan.	15
Am. Tin Plate pr..	81¾	.....	.....	.....	83	Jan.	2	80⅜	Jan.	12
Col. Fuel & Iron...	43	44⅛	41½	43½	46½	Jan.	3	40⅛	Jan.	8
Federal Steel.....	51	51¾	49½	51⅞	55⅛	Jan.	2	47¾	Jan.	11
Federal Steel pr....	73	74⅛	72¾	74	76	Jan.	2	70¾	Jan.	10
National Steel.....	42	42⅝	41	42½	46½	Jan.	3	41	Jan.	8
National Steel pr..	92½	92⅝	92	92	93	Jan.	2	92	Jan.	9
Pressed Steel Car..	58	58½	56⅛	56½	58¾	Jan.	17	56⅛	Jan.	2
PressedSteelCar pr	87	88¼	87	87⅝	88½	Jan.	17	85⅜	Jan.	9
Republic Steel.....	19¾	21½	19⅜	21¼	23¾	Jan.	3	19⅜	Jan.	18
Republic Steel pr..	65	68	64¾	67	68½	Jan.	5	64¾	Jan.	18
Tenn. Coal & Iron	84	86¾	82	85¾	87¾	Jan.	3	79¾	Jan.	11

Notes.

The statement of the condition of the United States Cast Iron Pipe & Foundry Co. on Dec. 1, 1899, shows a working capital of $2,449,815. Of this $1,502,873, inventory of raw and manufactured material, is taken at cost, and the advance in pig iron since the material was purchased represents in itself a considerable profit which will not appear upon the books until the goods are sold. The total profit from operations from March 13 to Dec. 1, 1899, was $759 386. This really represents only six months' business, because the company did not begin operations until May 1, 1899. The first dividend of 1¾ per cent on the $12,500,000 of preferred stock issued was paid Dec. 1, and the next dividend is due March 1. The profits already made are sufficient to pay the next two dividends on the preferred, while the earnings are at a rate of $80,000 per month. There are $1,199,000 bonds of the company, besides Anniston mortgage bonds of $122,500. There has been carried to the sinking fund for the redemption of bonds $15,000. Bills and accounts receivable are $1,536,874; bills and accounts payable, $832,052.

The annual meeting of the stockholders of the American Tin Plate Co. was held Jan. 16, at East Orange N. J. About $35.000,000 of the $46.325,000 isssued capital stock was represented. The following statement of the assets and liabilities of the company was made:

ASSETS.

Plants, real estate, machinery, etc.	$ 43,404,508.04
Merchandise, inventory	4,951,925.40
Accounts receivable	1,516,247.35
Cash	989,984.34
Total	$ 50,864,665 13

LIABILITIES.

Capital stock	$ 46,325,000.00
Purchase money mortgages	270,000.00
Accounts payable	1,656,236.98
Surplus	2 613,426.15
Total	$ 50,864,665.13

The following officers were chosen, all being re-elected: President, D. G. Reid; first vice-president, William B. Leeds; second vice-president, William T. Graham; third vice-president, Warner Arms; treasurer, F. S. Wheeler; secretary and treasurer, E. G. Applegate; assistant secretary, W. B. Wheeler; counsel, James B. Dill. Mr. Dill said: "The stock of the American Tin Plate Co. is scattered all over the country. Only about $960,000 is held by brokers. There are 1,500 stockholders in all, and of these 300 hold less than 100 shares each. Sixty-five trustees hold preferred stocks for estates. There is no pool in the stock, and no man, or small group of men, hold control of the company."

ANDREW M. MORELAND.

The Newly Appointed Secretary of the Carnegie Steel Company, Ltd.

Andrew M. Moreland, until last week auditor and assistant secretary of the Carnegie Steel Co., Ltd., and who a few weeks ago became a member of the board of managers of the company, was appointed secretary last week, succeeding F. T. F. Lovejoy, resigned. The new secretary is a type of Pittsburg's self-made men. He began life as a messenger boy and his career with the Carnegie Co. dates back fifteen years, when he was employed as a clerk in the accounting department. Mr. Moreland was born in Pittsburg, July 23, 1864. He received his education in the public schools and at the age of 17 accepted a position in the messenger service of the American Union Telegraph Co. Later he went with the Western Union where he was assigned the duty of delivering messages to the newspapers. In 1884 he started to work for Carnegie Bros., as clerk and bookkeeper. Five years later he was appointed chief clerk in the accounting department. In 1891 he was promoted to the position of assistant auditor, which he filled until 1895, when his ability was further recognized by his appointment as auditor and assistant secretary. In 1896 he was selected to negotiate the purchase of the Shenango & Lake Erie for the Carnegie interest, and one year later was made a member of the firm.

ANDREW M. MORELAND.

Unlike many men who have succeeded so signally, Mr. Moreland is modest and retiring, and his worth is best understood by the circle of his business contacts. Since he has been in charge of the accounting department he has introduced many innovations until at present the system in vogue in the auditing of the company's vast business, is one of the best in use.

The plant of the American Tin Plate Co., at Canal Dover, O., will be closed down indefinitely.

CUPOLA MALLEABLES.

BY E. H. PUTNAM.

I have written a number of articles lately on the manufacture of cupola malleables. These have been copied into various trade journals, giving them a pretty wide publicity. From letters of inquiry concerning the subject I find that there are numerous foundrymen who would be glad to take up the manufacture of the malleables used in their own business if they could see their way clear to profitable production. I have claimed that it is quite practicable to manufacture with profit cupola malleables (i.e., malleables from iron melted in the cupola), on a small scale.

Many quite large buyers are paying as high as four cents a pound for agricultural machinery malleables. The net profit to the manufacturer of these malleables is more than a cent and a half a pound. At the prevailing price of pig iron, cupola malleables can be produced on a small scale at a cost of less than three cents a pound. This, I think, pretty nearly covers the claims that I have made in my previous articles on the topic. It occurs to me, however, that a word of caution may be necessary in connection with the question. While it is true that a product of, say, 300 tons per annum can be profitably joined with the manufacture of agricultural machinery, it is assumed that the manager is thoroughly familiar with the business. The manufacture of malleable iron castings is an entirely different kind of business, in the main, from that of gray iron founding. It would be very unfortunate if any one of my readers should act upon the assumption, from what I have written, that any good foundryman is qualified to take up the manufacture of malleable castings without a previous thorough education in the art.

It is no doubt true that most users of malleable product buy instead of manufacturing; but that many of them could produce the goods for considerably less than they are paying is certain. There are various reasons for this situation. In the first place, when a manufacturing concern starts in business it is usually on a small scale, and a very inconsiderable quantity of malleable iron enters into the product, and this must perforce be bought outside. As time passes and the business grows, the hands of the officers are frequently so full as to preclude the possibility of taking up a radically different line of product. Furthermore, it often happens that land for shop room is entirely unavailable. In this connection I could name a great manufacturing concern that for something more than a dozen years past has purchased all of the chilled plow castings that enter into its product, simply because it is handicapped for room in its present factory, and there is no land for sale in proximity thereto. This company has, however, built a large malleable castings plant, and operates it with eminent success, making not only its own heavy tonnage, but also supplying hundreds of tons per annum to customers who might supply their own wants with equal success if they but knew it. But in this case the malleable factory is entirely disconnected from the other plant, both as to location and practical management. The principal owner probably knows very little about the practical manufacture of malleables. But this is no bar to the man who has the wisdom to employ men of ability rather than to sink his capital in a necessarily futile endeavor to conduct personally a business that he knows nothing about.

There is another reason why more concerns do not add to their business the manufacture of malleable iron. Some men are unconquerably averse to prosecuting any branch of business of which they personally are not masters. This, in some cases, is fortunate and in others it is unfortunate. The man of great executive ability will not hesitate to launch out in unfamiliar lines of manufacture if he is sure that others find it profitable, while the man who is wanting in this quality trembles at the thought of conducting a business of such magnitude that its details may lie beyond his personal touch.

Perhaps, however, the greatest of all obstacles to the manufacture of malleable iron castings by large consumers is the veil of mystery that has enshrouded the art in all the past. So firmly are people generally convinced that the processes connected with the production of malleable castings are involved, elaborate and mysterious, and withal hardly attainable, that they instinctively shrink from any attempt. And, naturally, the men who could tell them better will not do so, for men do not usually seek to build up competition against themselves.

The manufacture of malleable castings is a business that is destined to grow more rapidly than that of gray iron, for it is largely superseding gray iron in many classes of manufacture, notably agricultural machinery and railroad equipment. Some of the very large manufacturing concerns have a malleable castings plant in connection, and they are constantly displacing gray iron castings with malleable, because with the latter a given strength may be attained with much less weight. This makes their goods preferable, and it is only a matter of time when the stress of competition will compel a general adoption of the plan. In view of this fact, it seems to me that manufacturers of agricultural machinery generally would but consult their own interests if they were to take up the study of malleable iron manufacture without delay.

Lake Superior Mining Institute.

The next meeting of the Lake Superior Mining Institute will be held on the Menominee range, beginning at Iron Mountain, Mich., on Feb. 6. The local sub-committees are as follows: Finance—James McNaughton, E. F. Brown, O. C. Davidson, S. C. Bennett and Charles E. Lawrence. Reception—E. F. Brown, S. T. Beattie, H. F. Ellard, J. T. Jones and H. H. Dyer. Excursions and Railroads—O. C. Davidson, Martin Goldsworthy, E. F. Bradt, E. C. Wall and H. Truscott. Printing and Badges—Charles E. Lawrence, E. E. Brewster, F. A. Janson, J. Orrison and F. L. Coventry.

The following provisional program has been arranged: Tuesday morning on arrival of trains from the South and East a special train will convey the party to the mines east of Iron Mountain and the paper mill at the Lower Quinnesec Falls. On Wednesday the Iron River and Crystal Falls districts will be visited, and Thursday will be spent at the mines at Iron Mountain. The sessions for papers will be on Tuesday evening at Iron Mountain and on Wednesday evening at Crystal Falls. Papers will be presented by O. C. Davidson, H. H. Dyer, L. M. Hardenburg, James McNaughton and A. W. Thompson. A banquet will be given Thursday evening at Iron Mountain.

The Brass Founders' Supply Co., Newark, N. J., makes the announcement that its improved rib flasks are the only flasks of the kind on the market. Certain other flasks are made for which the same advantageous features are claimed but the Brass Founders' Supply Co. states that the flasks cannot be made without infringement. The imitation flasks are made with the ribs reversed and projecting inside of the edge of the flask so far as to interfere with the pattern and tucking the mold when that is necessary. As a general thing molders and brass founders throughout the country understand this, but the imitation flasks are sometimes purchased by those who do not understand the difference. The Brass Founders' Supply Co. make a flask that is especially noteworthy in point of finish. The others referred to are made on a basis of a patent issued in 1855, for flasks in which to cast bath tubs, these bearing no real resemblance to the flasks offered by the Brass Founders' Supply Co., though similar illustrations are used.

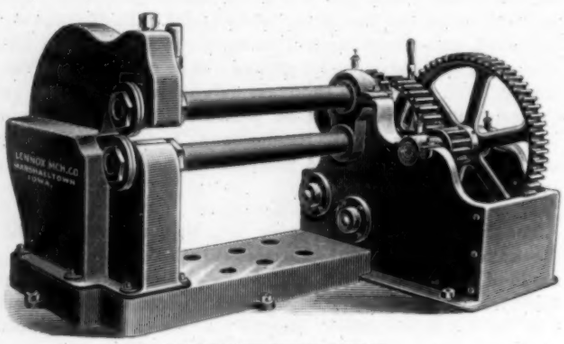
Work on the new plant of the Sharon Steel Co., Sharon, Pa., has been commenced and it is the intention of the officials of the company to have it in operation within 15 months. The Shiffler Bridge Co., Pittsburg, has the contract for the construction of 10 buildings under way. William Tod & Co., of Youngstown, O., have secured the contracts for a 50x60-inch reversing engine for the blooming mill and also two steeple type compound blowing engines. The Lloyd-Booth Co., Youngstown, will build the blooming mill and install the tables and shears, and the Riter-Conley Mfg. Co., of Pittsburg, will build the blast furnaces. The U. Baird Machinery Co., also of Pittsburg, already has contracts for the installation of machines to cost about $50,000. This last contract will be increased shortly.

The Crumlish Forge Co., Buffalo, N. Y., is full of work and much behind with its orders. The unprecedented activity in shipbuilding has proved most fortunate for this firm. During 1899 over 50 per cent of its shipments of portable forges were for shipyards; and thus in 1900 all its orders have been for shipyards, including several for foreign yards.

ROTARY SPLITTING SHEAR.

The Lennox Machine Co., of Marshalltown, Ia., manufactures a rotary splitting shear, of which an illustration appears below. This machine is designed for cutting sheets and plates. It will also cut round, square and flat bars up to a diameter or thickness equal to the capacity of the tool for plates. A feature of this tool is the self-feed. There is no difficulty in forcing sheets or plates through, as the knives or discs feed the material through as they revolve. The sheet is very easily guided. As the plate is cut, one part passes at the front of the frame while the other part passes at the back and slightly downward. There is ample clearance, allowing a slight variation from a straight line. The machine is also employed in cutting heads or outside circles, where the scrap or piece which is cut from the plate is not too wide.

The shear is made with 4-inch, 6-inch and 8-inch throat and of a capacity to shear up to ¼-inch stock. Any depth of stock can be made by lengthening the shafts and base plate. The knives are about 2 inches in diameter, of cast tool steel, and about 30 inches in circumference. The cutting surface being greater than in the ordinary splitting shear gives longer life. The knives are reversible and will not need redressing or sharpening until both sides have become dull. Equally good work is done on thin and thick plates. The machine is provided with a friction clutch pulley and the gearing is extremely strong, with a ratio of about 1 to 80. The 6-ft. throat machine weighs approximately 7,000 lbs., and the main shafts on the 6-ft. and 8-ft. machines are 5 inches in diameter. The machine has been offered for sale only recently, but the manufacturers have been using one in their own works for some time and after testing its practicability offered it to the general trade It is adaptable to the needs of boiler works, shipyards, locomotive works, plate mills and bridge works.



ROTARY SPLITTING SHEAR.

Missouri Lead and Zinc Mines.

Prof. F. Lynwood Garrison read a paper at the meeting of the mining and metallurgical section of the Franklin Institute, at Philadelphia, Jan. 10, on "The Lead and Zinc Mines of Southwestern Missouri." These mines are in the Joplin district, and it is the belief of Professor Garrison that it is destined to become the greatest zinc producing district in the world. Speculators are spending vast sums of money there at the present time, it being estimated that $40,000,000 was expended in 1899 in the development of the mines. It is, however, a surprise to learn that the increased output has only been 9 per cent for 1899 over 1898, while 1898 showed 29 per cent increase over 1897, and 1897 showed 23 per cent increase over 1896. It is not easy to understand why last year should show such a relatively small increase, and the two previous years so marked an increase, when one considers the vast sums expended in 1899, and the high price of ore. The value of the district's production was nearly $11,000,000 and the cost of production about $8,000,000, leaving a small amount out of which to pay dividends on such large capitalizations. Professor Garrison's paper was well illustrated by slides and specimens.

At the annual meeting of the New England Foundrymen's Association held at Boston, Jan. 10, the following officers were elected, two or three changes being made from the list of nominees previously published: President, Geo. B. Bucking-

ham, Arcade Malleable Iron Co., Worcester; vice-president, H. A. Carpenter, A. Carpenter & Sons Foundry Co., Providence; secretary, Fred. F. Stockwell, Barbour-Stockwell Co., Cambridgeport; treasurer, Geo. H. Lincoln, Geo. H. Lincoln & Co., South Boston. Executive committee—F. B. Farnsworth, McLagon Foundry Co., New Haven; T. H. Colvin, Colvin Foundry Co., Providence; Wm. Doherty, Doherty Bros., Lowell; E. E. Durant, G. F. Warner Mfg. Co., New Haven; B. M. Shaw, Walker & Pratt Mfg. Co., Watertown.

A NEW RAIL BENDER.

The accompanying illustration represents a device now in use on the Pennsylvania Railroad for bending and straightening rails. In most rail benders, the rail is held at two points, and pressure is applied at an intermediate point. In this machine, however, the rail is held by a claw on one end of a heavy lever, and pressure is applied by a capstan-headed screw at the other end. The screw is fitted with a cap, which bears against the rail, and in which the end of the screw revolves on a roller bearing. In the machine illustrated, the lever is 16 inches long, from the center of the screw to the center of the claw or grip, and has broad webs with thick heavy flanges. The screw is 17 inches long over all, 2½ inches diameter over the threads, which are of square section, with four threads to the inch. Two ¼-inch washers, of tool steel and phosphor bronze, are placed between the screw and the cap. The lever, screw and cap are of cast steel, and the total weight is 113 lbs. This tool is styled the Samson rail bender, and is one of the specialties of the Q. & C. Co., of Chicago.

NEW RAIL BENDER.

Casting Steel Without Blow Holes by a New Process.

Much difficulty has been encountered by users of steel in getting perfect castings, in spite of the many experiments made to obviate the troubles. A new process has been perfected recently by which the inventors claim excellent results are secured. The feature of the product under this process is the liquefaction of the molten steel to such an extent that small cross-sections of any shape are readily run true to pattern, of smooth surface free from blow holes having great tensile strength and of such carbon as may be required. This process, it is believed, fills a wide gap in the steel casting business, making it possble to produce in castings a large variety of different shapes of high quality, such as have had to be made heretofore in expensive forgings. The process is being put into operation by the Hercules Steel Casting Co. at Harvey, Ill.

An office has been opened at 939 and 941 Monadnock Block, Chicago, by the Northern Electrical Mfg. Co., of Madison, Wis., manufacturer of dynamos, motors and other electrical machinery. The office will be under the management of O. W. Bruner, who will be assisted by a staff of engineers thoroughly experienced in the line of work conducted by the company.

A CHIMNEY FREAK.

There are few mechanical engineers who have not had experiences, in the course of their career, which were exceedingly puzzling at the outset, but which became ludicrously simple upon investigation. An instance of this, from our own practice, forms the subject of the present article. A certain apartment building was to be heated by steam, and our experts were retained to design the plant, and supervise its installation. The contractor appeared to be making an honest effort to do his work right, and we were well satisfied with the general course that things were taking, and anticipated no trouble whatever, as the radiators and the heater were ample in size, the piping was well arranged, and the work, as we have said, was being well done so far as we could judge, from our periodical visits to the building while the plant was being put in.

It is the unexpected which happens, however, as Professor Sweet has so well said; and when the boiler was fired up for a trial, we were greatly surprised at its misbehavior. In order to make the case intelligible let us first give a few details of the arrangement of the plant. The steam for the system was furnished by a boiler which discharged its products of combustion into a circular flue, 20 inches in diameter, which is shown in the illustration. It was necessary to provide the tenants of the building with hot water as well as steam, and, as the hot water would be required throughout the year, while the steam would be needed only during the winter, a small auxiliary boiler was provided for heating the water, so that it would not be necessary to run the big one through the summer. The small boiler was supposed to discharge its products of combustion into a separate flue, nine inches square, which was built by the side of the big circular one, as indicated in the illustration.

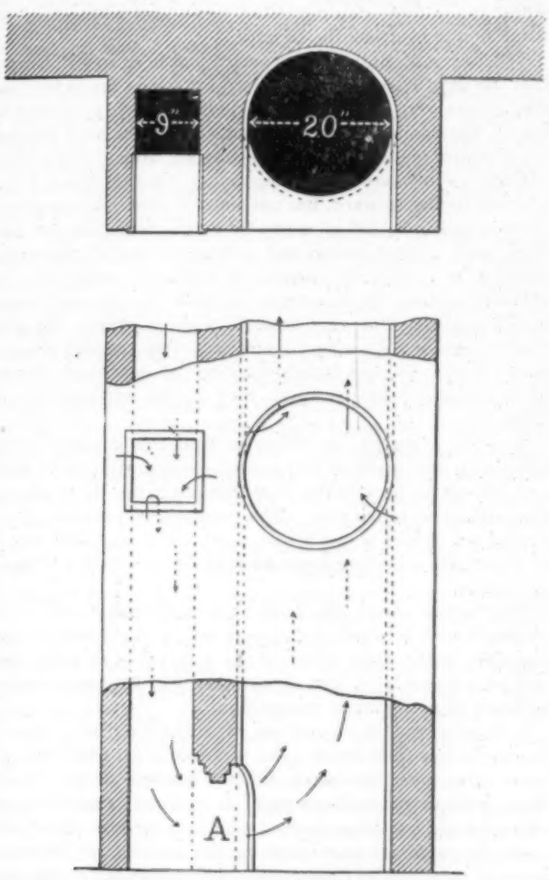


DIAGRAM SHOWING CHIMNEY AND COURSE OF THE DRAFT.

When the preliminary test was made, it was found that the draft was very poor in both flues. The dampers were pulled wide open, and every effort was made to accelerate the combustion in the furnaces, but nothing would induce the fires to brighten up into anything like the condition that we wanted to see. Plainly, the thing wouldn't work; and, as we knew how everything was proportioned and arranged (or thought we did), it was hard to understand how the things that were, could be. After a good deal of hard but unprofitable thinking, and a few superficial experiments that didn't show anything, we had the nine-inch smoke pipe pulled out of its flue. A candle was then lighted and held up to the opening. It showed that there was a draft into the flue. We then pushed the candle away in, until it entered the vertical part of the flue, and the thing that happened then was so startling and altogether unreasonable that the contractor, who was assisting in the operation, made a few cursory remarks. The flame of the candle was drawn straight downwards, and with such violence that the flame burned blue for a second, and then went out. There was good enough draft in the flue, but it went down, towards the bowels of the earth.

A section of the front of the flue was then torn out, and it was found that the mason, who seems to have known very little about draft and combustion, had made a large and very neat opening between the two flues at the bottom, as indicated in the sketch by the letter A. The steam heater had warmed up the air in the 20-inch flue, and started an upward current there, and a powerful circulation had been established, the outside air going down the nine-inch flue, around through the opening at A, and up through the 20-inch flue again.

A supply of bricks and mortar was obtained, the opening at A was walled up as shown by the two dotted lines, and the front wall of the flues was replaced; and after this we had all the draft that any one could wish; and the engineer said that he "had to run with his dampers shut, to keep the safety-valves from scaring the tenants to death."—[The Locomotive.

THE BIDS ON THE ATBARA BRIDGE.

At the December meeting of the Engineers' Club of Philadelphia a paper was read by Mr. Richard Khuen, Jr., on the Atbara River Bridge, which gives the following facts about prices and terms of delivery:

In response to the call for aid, the British Egyptian Government made inquiries in England early in October concerning this piece of construction. A promise of one year for shop-work and one year for erection was all that could be obtained. The reason given by the British manufacturers for this very slow work was the overcrowded condition of their shops. Second tenders were then asked of two American and five British firms, speedy delivery being the main consideration. The table gives the name of firms, prices, and time of delivery promised:

	Liverpool.	New York.	Delivered in Liverpool.	Delivered in New York.
United States:	Cts.	Cts.	Months	Months.
Maryland Steel Co	2.55	2.30	4	3⅝
Union Bridge Co	2.95	2.66	3¼	2⅞
England:				
Horsley	2.89		3⅝	
Head, Wright & Co	3.00		6–9	
Joseph Westwood	3.22		4½	
	3.05		6½	
Patent Shaft and Axle Co	3.42		5½	First span in 2 mos.
Thames Iron Co	3.45		5–6	

These tenders, together with plans, reached Egypt the latter part of December, 1898. It was then found that, since the bidders contemplated the use of false-work for erection the work of erection could not be prosecuted until after the summer floods, and could, therefore, not to be completed until the following winter or spring, which would mean the loss of a year. Accordingly, new bids, based on cantilever erection or launching, were asked for from all the firms already mentioned, to which was added the Pencoyd Iron Works. The following bids were received, the Patent Shaft & Axle Co. being the only British firm responding to the final call:

Patent Shaft & Axle Co., 3.37 cts per lb.	First span delivered in Liverpool in 2 months, and the rest each in 3 weeks (total 6 months.)
Maryland Steel Co 2.3 " "	3⅝ months in New York.
Union Bridge Co 2.79 " "	65 days in New York.
Pencoyd Iron Works 2.5 " "	42 days in New York.

The Pencoyd Iron Works, allowing two weeks for shipment to Liverpool, promised the delivery of the work in one-third of the time asked for by the British firm and at a much lower price per pound. However, the price per pound of the Maryland Steel Co. was slightly lower, but the time was more than twice that of the Pencoyd Iron Works.

ECONOMIC CHANGES OF TWO DECADES.*

BY HARRY J. LEWIS.

The year just past and possibly the one before us, marks the crest of one of the great tidal waves which occur in commerce and industry at intervals of about two decades. After a period of depression during which a whole nation learned to purchase and consume only for its bare necessities, and in which each producer strove to bring forth the maximum of product with the greatest possible economies, we now find ourselves with a comfortable balance of foreign trade in our favor and capital long idle or poorly invested, ready to embark in enterprises which promise a fair profit. In 1879 our country had recovered from the panic of '73 and entered upon a period of activity similar to that of the present except along different lines. At that time the demands upon us for flour and beef were so great and pushed prices to such a point that it was at once profitable and necessary to develop new areas of production. This was accomplished by large extensions of railroads into new territory and the encouragement of emigration thereto of a population of producers. Labor-saving machinery in the production of farm crops was well introduced previous to this time and under the favorable conditions of large demands and high prices, its use and improvement was greatly stimulated. The agricultural population was therefore actively and profitably employed, large forces of consumers were busy with the construction and operation of railroads, while the mines, the mills and the workshops were busy with needed supplies. Great consolidations of railroad properties into trunk lines were completed and necessary feeders were built, our remaining agricultural areas were rapidly settled and developed, while great industrial communities were formed where agricultural products were put in shape for consumption and where supplies were produced for the rapidly specialized demands of modern civilization.

For a time, the general activity of the country supported a demand for all its products, and at good prices, but this in turn stimulated production until it finally reached the point of internal competition. Our farming areas were extended until they not only included everything having sufficient rainfall but also arid regions which could only produce by irrigation and at times of comparatively high prices. The building of railroads was so hotly pushed in the race for strategic territory that different lines often became competitors before either one had developed a paying traffic. The workshops were pushed until the farmer was supplied with implements; the railroad with rails, cars and engines and other industries were loaded up in a like manner until the problem of production became more a matter of maintenance of the old than the construction and sale of new machinery. The development of mines, on account of the great areas available and the small investment required, was carried forward until competition between them became their worst enemy.

The flush times of '79, therefore, gradually drifted into the depression of '83, which was the natural result of the causes above mentioned, together with others more obscure. After a short lull, however, the demand in many lines began to increase, and the general condition of the country was easier. About this time, the American farmer who had been finding a foreign market for his surplus breadstuff, began to feel the competition of Russia, Egypt and India. He was thus in a position from which he knew not how to turn back with profit as the demand for beef and pork was spoiled by the increased number engaging in their production as the prices of breadstuff fell. The whole agricultural community was, therefore, gradually reduced to a condition of the most rigid economy. While the farmer was wading gradually deeper into misfortune, many of the industries of the country accompanied him, while others were temporarily bolstered up by a structure of legislation and combination as to prices; but even these suffered from decreased market. But unnatural conditions cannot long survive, and in '93 these latter were suddenly dropped into deep water along with the rest. Many plants were closed down and only those with low cost of production were able to continue. It was a clear demonstration of the fact that artificial conditions cannot long endure against natural causes. In this connection, it may be noted that nearly all of the Western roads which attempted to protect their communities by giving low long-haul rates to put them in competition with more fortunately located producers of the East, were forced into bankruptcy.

The panic of '93 left just one alternative before every business man, manufacturer and corporation; either to show complete ability to settle all outstanding obligations in full or be declared insolvent. Settlement day had come and many parasites were removed from the business world, obsolete plants were closed and unsound corporations went into liquidation. The lesson of economy was forced upon all, from the greatest corporation manager down to the poorest laboring man. The obligations of men and corporations were either wiped out or scaled down to a paying basis. Economies in production and consumption alike, were forced upon those who had heretofore neglected them. Our imports were gradually reduced and under the stimulus of cheapened production and lower prices, an increased stream of exports flowed outward, until finally the balance of foreign trade was in our favor and our own people began to absorb, at a greatly reduced price, many of our securities formerly held abroad. During this time we wore out everything from old machinery to old clothes and laid the sure foundations for a healthy demand when the proper time should arrive. The production of everything, from wheat to pig iron, was restricted by natural causes until demand finally overtook the supply.

The lessons of caution and economy had been so well learned that our improved condition existed for some time before serious efforts were made to provide for the rising wave of demand; but finally it burst all bounds and in the year just past the producer found his condition changed from that of a seeker of business to where the business eagerly sought him. Prices eventually shot upward, but not until a great volume of production had been tied up at the old rates. This has now been fairly well cleared away and producers are, at present, in position to receive full benefit of improved conditions. Increased capacity is demanded to take the place of former plants abandoned because obsolete and to supply the additional needs of a growing population. The reduced prices of many of our products during the time of depression carried them into new fields in which they persist and must be provided for.

A period of activity is before us until the country is supplied with new material and appliances according to its needs and we settle back to the maintenance of the old in place of the production of the new. The volume of exports developed during our period of low prices, is a hopeful sign and may be of great help when the home demand for new material begins to decline.

The period above has been thus roughly sketched for the reason that in no other of the same length has the American engineer been called upon for the solution of so many great and varied problems, and, in no other has he been accorded so much of professional recognition.

Following up the expansion of railroading with which it began, he has been called upon to locate great and small systems, often over the most difficult ground in the country. The problem of roadway with its auxiliary structures and construction, has been worked out by a process of exclusion until all roads are now following the same general lines, instead of the chaos of design and construction of twenty years ago. The efficiency of motive power and rolling stock has been fully doubled in every respect. Terminal problems, then in their infancy, have in the meantime demanded, if anything, more ingenuity than the location of the trunk lines which required them. The abolishment of grade crossings, especially in cities with heavy street traffic, has required careful and ingenious handling, not only in construction but in providing for train movement while changes were made.

The different mining interests, from which so much of the railroads' traffic is derived, and upon which their operation so greatly depends, have increased in full proportion to transportation facilities. As to mining methods, 20 years ago we were largely dependent on foreign engineers and foreign methods, while today the American mining engineer and his distinctive methods have won a recognition at home and abroad.

A great and rapid concentration of population in cities which came with railroad development, has set new and

* Extracts from annual address of the retiring president of the Engineers' Society of Western Pennsylvania, Pittsburg, January 16, 1900.

difficult problems before the engineer. Water supply, sewering and sewage disposal, street construction and cleaning, city and suburban rapid transit, lighting, heating, power distribution, telephonic communication, and vertical construction of buildings have made strides which can hardly be realized until we reflect that in 1879 the telephone was little more than a curious plaything, while the dynamo and arc light were more of laboratory experiments than commercial facts. On all of these things the engineer has placed his mark with a bold yet careful hand.

Twenty years ago we were dependent upon foreign sources for a large percentage of our supply of the useful metals, notably iron and steel. With the development of our mines and railroads has come the construction of furnaces and mills more than ample for our own needs, and under the hard schooling of the late depression we have developed economies of method which may enable us to do more than balance our debts of foreign material incurred in the past.

The swings from general prosperity to depression are felt by the engineer in a practical way both as to their direct effect upon his income and in the variation of problems set before him. In flush times he is called upon to plan a great amount of work with little time for reflection, and this is rushed through wth more or less disregard of cost. These things are then called upon to go through a time of depression and still earn dividends. It is impossible to change this, as things are now ordered, but it is no less a matter for regret that problems of great moment which are set before us for hurried solution, could not have the benefit of reflection during some of our leisure hours. In slack times, we are called upon to aid in the work of retrenchment, both as to ways and means, and also as to our incomes which share the general pruning.

The past year has been a remarkable one in many ways. The business of the country has shown a recuperative power, both as to volume and price, which even those best informed could hardly foresee. Great combinations of capital have been built up into industrial enterprises whose efficiency and economy should be greatly increased thereby. Those of them which include mainly well-built modern plants with low cost of operation require only careful, broad-minded management to endure. Others, which have taken over a large percentage of the old inefficient plants, can hardly escape disaster with a consequent weeding out of that which is obsolete. Heretofore, trunk line railroads have been the most notable examples of large blocks of capital controlled under one head. If the example of the best managed roads is worth anything, the great industrial corporations will avail themselves of the best obtainable engineering service, and the young men starting in this department will be utilized, after proper training, in operation and management.

The total of horse power, in steam engines and other prime movers, which was added to the world's stock during the past year is easily greater than ever before and the amount of our contracts abroad show that we are not falling behind in design.

ANNOUNCEMENT is made of plans for the building of a new railroad that will be important to Johnstown, Pa., steel interests. It will run from Erie, Pa., to Johnstown, linking the lakes to the Chesapeake by a new route, and forming a short line from Lake Erie docks to the seaboard. A branch to Pittsburg is proposed, giving a new outlet to the Chesapeake and the Atlantic seaboard. The new line is said to be projected by New York capitalists, one of whom is John B. McDonald, the contractor who recently received the contract for constructing the great traction tunnel in New York. Included in the scheme is a proposed line from Black Lick station, near Blairsville, to Pittsburg, entering the city by way of the Pittsburg & Western, Pittsburg Junction and the Baltimore & Ohio Railroads. The line from Erie to Johnstown would be but 210 miles, long but would develop one of the largest coal fields in Western Pennsylvania. Nearly all the coal land in Indiana county and large blocks in Cambria, comprising altogether about 120,000 acres, have been purchased outright or leased and the Cambria Iron Co., it is said, will spend next summer several millions in improvements and extensions. It is stated that the Cambria company has had under consideration a contract with the proposed road for the delivery of a large tonnage of ore over a term of years.

THE CHEMIST'S PLACE IN THE FOUNDRY.

TO THE EDITOR:

The able article of Dr. Edward Kirk in the last issue of *The Iron Trade Review* emphasizes the chemist's responsibility for results in making mixtures. My experience and observation would not permit an endorsement of the views advanced. The one great mistake of some founders who endeavor to be guided by analysis in making mixtures is that they think the chemist should be held responsible for the final results, for the quality of the iron in the casting. There is about as much reason in this as there would be for a blast furnace manager to think of holding his laboratory responsible for the grade of iron coming from his furnace. All that is expected of the blast furnace chemist is that he analyze the materials going into a furnace and the iron coming from it. With materials of exactly the same character going into a blast furnace at different times wholly different grades of iron can come from them. In a measure the same is to be said of the cupola. Still further, after the iron has come from a cupola, he is a poor molder that cannot make two molds off the same pattern, one giving a different grade of iron from that of the other, both poured from the same ladle of metal.

To understand the hundred and one things that can change the grade of iron after it is charged into a cupola, put through the process of melting and at last poured into the mold, generally requires a long experience as a founder. A good chemist gives up several years of his early life to learning to make analyses and when he has done this it is all that should be expected of him, so far as the responsibility for the grade of iron obtained in castings is concerned. The trouble with the founder who does not make a success of working by analysis lies with himself in not studying what effect varying percentages of silicon, sulphur, phosphorus, manganese, carbon, etc., may have in changing the grade of an iron. He conceives the idea somehow that a chemist should know these things and engages one to look after such work. It is not until much loss has been incurred by reason of the founder's and chemist's lack of knowledge, that the former either takes the matter in his own hands or condemns chemistry; whereas, had the founder but understood the chemist's proper place and his own duties before starting in to adopt analysis the work would have been successful. It is not to be understood that a chemist could not work up to the point of understanding as much as the founder might attain in this field. But even did the chemist work up to an understanding of results due to variations in the metalloids, the fact that the founder can change results after iron has been charged, makes the responsibility for final results in mixture one that I am sure a wise chemist would not accept. "Let the shoe-maker stick to his last." The saying applies very forcibly to the founder who will not acquaint himself with the results of chemistry in making mixtures and thinks to have a chemist carry the load for him. The chemist's best place is in the laboratory, just as at the blast furnace, and a founder who would take a chemist out of his field to do work properly his own deserves to reap the failure sure to come. The chemist's part in aiding the founder should be as independent of responsibility for good castings as is the work of the pattern maker, machinist, or blacksmith in assisting the founder to complete his appliances for making molds. The founder that pursues this policy and studies for himself the variations due to changing percentages of the metalloids will make chemistry in the foundry a success.

THOS. D. WEST.

Sharpsville, Pa., Jan. 22.

The Dunbar Furnace Co., Dunbar, Pa., is reported to have secured 2,000 acres of coking coal land in Dunbar township, Fayette county.

THE Brass Founders' Supply Co., Newark, N. J., recently shipped another large order for its improved "rib bed flasks" to Bedford, Eng.

At Ironton, O., the property of the Mt. Vernon Furnace Co., including 9,000 acres of land, was sold to Col. J. H. Moulton and associates for $32,000. The Vernon Iron Co., which the purchasers have incorporated, may build a new blast furnace, but no definite decision has been made.

HIGH DUTY CORLISS AIR COMPRESSORS.

Types of the high duty air compressors manufactured by the Ingersoll-Sergeant Drill Co. are shown in accompanying illustrations, two of which are of compressors doing service at well-known mining properties. Fig 1 is a view of a cross-compound condensing Corliss compressor installed at the Aurora Iron mine on the Gogebic range. Fig. 2 shows a four-stage duplex high pressure air compressor, designated as class G. Fig. 3 is a plan and elevation of a Corliss cross-compound air compressor of class C1. We have given heretofore, in connection with a photographic reproduction of the duplex Corliss air compressor installed by the Ingrsoell-Sergeant Drill Co., at the Lassig Bridge & Iron Works, some details of these compressors that employ a Corliss engine. The Ingersoll-Sergeant piston inlet air cylinder, in combination with the Corliss engine, is built for ultimate economy—the economy of continued operation, as against a slight additional first cost. Economy in fuel is a prominent point, as are also small liability to break downs, light cost of repairs and small amount of attention from the engineer. The use of the Corliss engine has reduced the consumption of water per horse power to as low as 12 pounds an hour, as against 60 and 70 pounds with earlier engines. Some of this saving, it is granted, is due to a better understanding of the laws of heat transmission and of conversion into power. The advance in the matter of fuel consumption has been noteworthy, but one-fifth the original amount of coal being required.

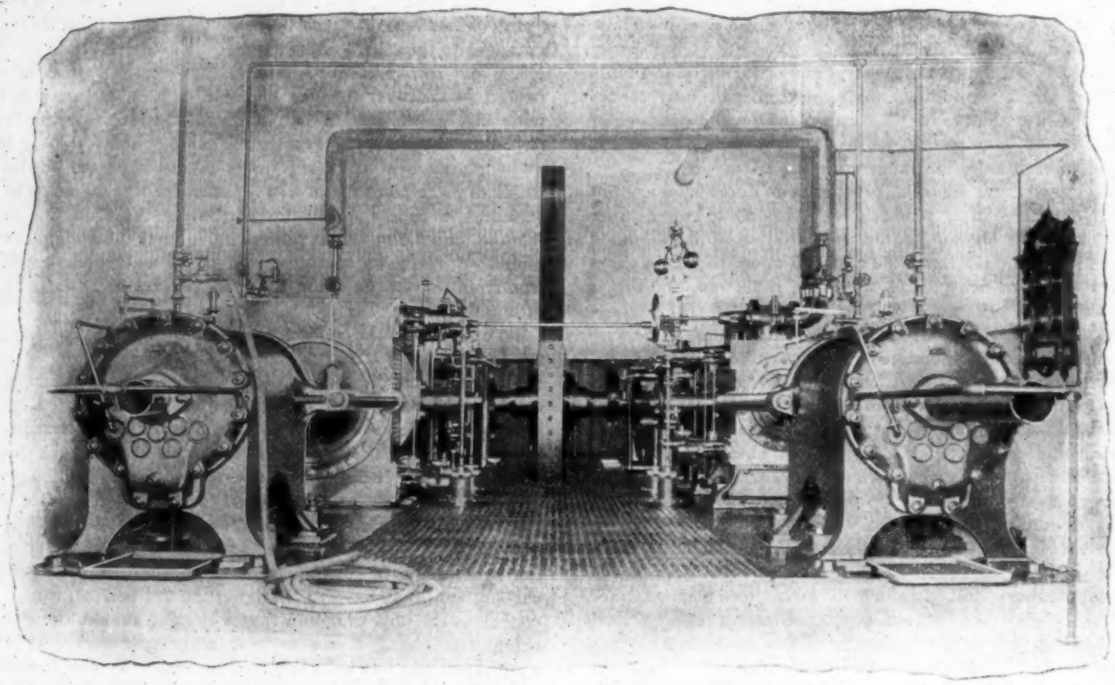


FIG. 1.—CROSS COMPOUND CONDENSING CORLISS AIR COMPRESSOR, AURORA MINE, IRONWOOD, MICH.

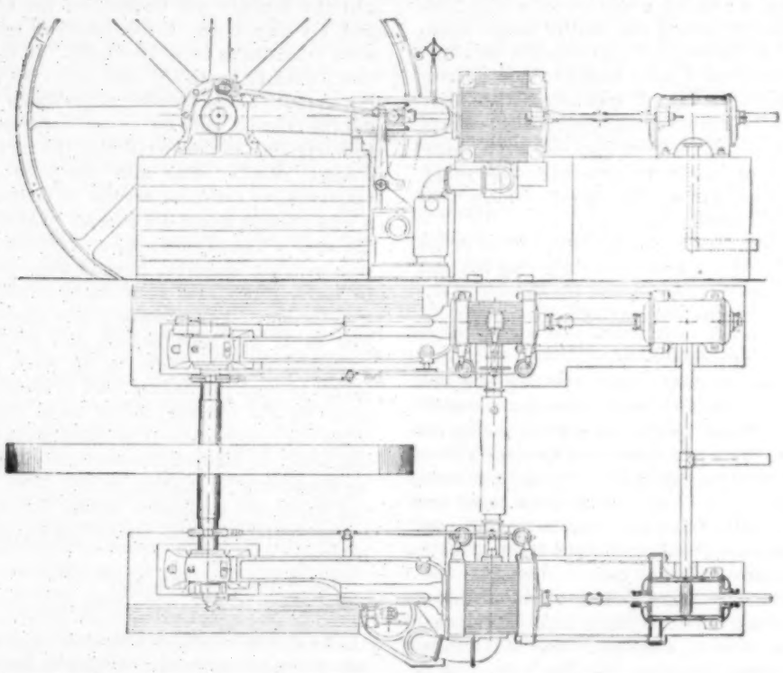


FIG. 3.—PLAN AND ELEVATION OF CORLISS CROSS COMPOUND AIR COMPRESSOR.

The compressor shown in Fig. 1 has a high pressure steam cylinder 22 x 42 inches, a low pressure steam cylinder 40 x 42 inches, and air cylinders 24¼ x 42 inches. The Class C1 compressor shown in Fig. 3 has compound steam cylinders and simple air cylinders. Fig. 2 is a high pressure compressor installed at the Rolling Mill mines of the Cambria Steel

Co., Johnstown, Pa., for mine haulage with pneumatic locomotives. The steam cylinders are cross-compound of 350 h. p., and the air cylinders are four-stage for working pressures of 850 to 1,000 pounds. The Ingersoll-Sergeant products in stage compression range from the lowest point of practical economy up to the highest pressures necessary for converting air from a gaseous to a liquid state. Machines have been built for compressing in two, three, or four stages, obtaining pressures of thousands of pounds to the square inch, with temperatures at no stage higher than common compressors produce at ordinary pressures. A system of complete jacketed cooling between stages is employed with special arrangement of inlet and discharge valves.

PROGRESS OF THE MECHANICAL ARTS.*

BY COLEMAN SELLERS.

The greatest advance in mechanics has been manifested since the advent of the locomotive. It so happens that the birth of the modern railroad system is coincident with my own birth. At that time the first railroad was put into operation in England, which development, taken in connection with the advent of the steamboat which preceded it, was certainly the exciting cause of the great industrial advance that has since been made. Previous to 1827 wooden rails had been laid to form roads over which ore was hauled from the mines, and coal was transported in the same manner by animal traction to better advantage than over common roads. Oliver Evans in our own country, and other engineers abroad, had conceived the idea of the high-pressure steam engine, and with the full understanding of its value, a practical traction engine to use on roads, was one of the first examples of its application. It was after the invention of the road engine that the locomotive upon rails became possible.

The traction engine applied to the railroad was the basis of our present wonderful system of inland intercommunication, and its development has given an impetus to all trades. In fact, the wants of the railroads taken alone would have been sufficient incentive for what has since been done in the mechanic arts, engaging, as it has, the attention of engineers to produce the labor-saving tools required for the improvement and preservation of the railroads and equipment, including the great iron and steel works that supply the rails, bridges and buildings. Special machinery has been constantly needed to render possible such industries as iron ship-building, bridge and structural work, and the appliances which have been introduced in place of hand labor throughout the industrial world.

The progress of the single industry of machine tool building has, therefore, a most important bearing on this subject, and traced through the many stages of its rapid growth, the development of this one industry would be sufficient to illustrate the progress in mechanic arts during the period in question, and especially what has been accomplished in this country. As one instance of progress from primitive methods during the period under consideration, it may be of interest to refer to the construction of one of the first large engines that were built for the city water works in Philadelphia. There is probably no one present who can recall the fact from actual memory, but where our public buildings now stand there was once a smaller structure, on top of which was a tank into which water was pumped, and this water was distributed through the then small city below Broad street by means of wooden pipes of comparatively small size. The engine used in this work was, I believe, of the Oliver Evans type of high-pressure engine, the cylinder of which was cast in New Jersey. The boring bar used in boring out the cylinder was of the crudest character, operated by hand by means of levers attached to it, so that men walking around the cylinder could propel the cutting tools, and gradually force the cutters on the boring bar, through the cylinder, until it had been turned out approximately true. After that the inner surface had to be filed to a sufficient degree of smoothness. Probably a month was consumed in this operation of boring the cylinder. As I shall take occasion to mention, the subsequent improvements in machine tools have changed the process of cylinder boring from an effort of days to the work of a few hours.

It may be of interest also to note that when the engines were erected and the boilers put in their place at this Center Square Station, the latter were found upon test to be insufficient for their purpose. Oliver Evans had specified the length of the grate bars and the width of the furnace to be used, as also the length of the boilers, which were of the plain cylinder type, but the wise men of the city government believed that they could do better by making the boilers much longer than he had suggested, and they were so constructed. Upon their failure to do the work, Oliver Evans, who was in New York, was sent for in haste to correct the difficulty. His message to those in charge, enforced by his presence afterwards, was that they must cut off 10 feet from the length of each boiler. This seemed a strange proceeding, but he soon explained to them that the extra length which they had added to his prescribed dimensions was acting as a condenser to reconvert steam into water, inasmuch as the heat of the fur-

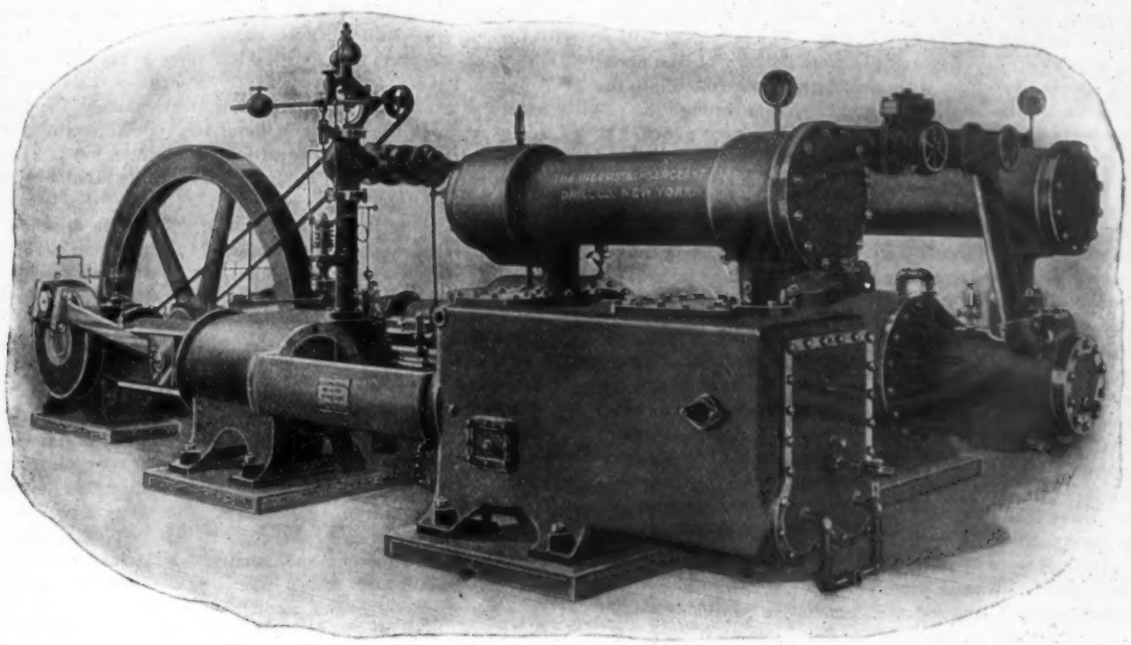


FIG. 2.—FOUR-STAGE DUPLEX CLASS "G" HIGH PRESSURE AIR COMPRESSOR, AT ROLLING MILL MINES.

*Extracts from an address at the 75th anniversary celebration of Franklin Institute, Philadelphia, Pa.

nace could not extend the whole length of the boilers as they had been built. Upon cutting the boilers down to their proper size so the heat could extend over their whole fire surface, they proved sufficient for their work, and continued to operate as long as this primitive water plant was in existence. I have this story from those who were living at the time. I hope I may be pardoned for alluding here to some events in my own experience as a mechanic in order to justify my authority as a historian. From earliest childhood my interest has been led in the direction of the mechanic arts. My first knowledge of physics came from my father, through his instructions and experiments for my benefit before I had fairly passed out of the stage of infancy, for I was but seven years old when I lost so able a teacher. As a schoolboy most of my holidays were spent in his machine works at Cardington, near Philadelphia, where I had abundant opportunity to not only know what was being done at that time, but I had from my seniors the history of what had immediately preceded my personal observation.

My acquaintance with the rapid advance in the railroads of America, and in the motive power on the roads, dates from the time when the building of locomotives was undertaken in my father's shops, immediately after Matthew Baldwin had started his works in Philadelphia. When I was 19 years of age I accepted service as draughtsman in a rolling mill in Cincinnati, where rails were being made for the roads then projected through the Western States. The rails used at that time, which were called strap rails, were flat bars of iron about 3 x 1¼ inches in section, with oval depressions rolled into the face to receive the head of the spikes driven through the rail to fasten it to string pieces of wood. They were punched at each one of these depressions, which marked the location of the spike hole. At that time the most common accident on the railroads was one unknown now, namely, "snake-heads," as they were called, when the strap rails, by the action of the wheels upon them, would curl up, drawing the spikes from the wood, and often piercing the bottom of the car, and not infrequently killing or injuring passengers.

After my experience in the rolling mill, where I acquired a knowledge of the wants of the railroads, I was engaged for seven years in locomotive building, first in constructing engines for the Panama Railroad, in connection with one of my brothers who was the inventor of a locomotive for ascending inclined planes. The late John C. Trautwine was the consulting engineer of the Panama Railroad, and it was on his recommendation that these engines were ordered, in the belief that some heavy inclines would have to be overcome in passing from the Atlantic to the Pacific Ocean at Panama, although these inclines were avoided, and the engines eventually used in the construction work merely.

Subsequently I entered the locomotive works of Niles & Co., of Cincinnati, as foreman for five years until 1857, when I accepted service as chief engineer for William Sellers & Co., of Philadelphia, then, as now, engaged in building machine tools. Thirty years' active experience in machine tool building enables me to speak from a full knowledge of this industry and what machine tools have done for the advance of the mechanic arts. When engaged in locomotive building in Cincinnati, I introduced a number of improved methods, but was hampered continually for the want of machine tools powerful enough to do the work as I desired it done, as well as for the want of special tools not then available. At that time in the Eastern cities certain machine tools were being built with success and were doing far better work than it was then possible with tools built in a branch of the locomotive works where I was engaged. The firm of Niles & Co. had, however, some reputation even then as builders of machine tools and sugar machinery, but it was not until the retirement of the original founders of the house that the works became devoted wholly to the machine tool business. At the time I speak of, slotters, horizontal boring machines and lathes of various kinds and quality were built in America after the introduction of the planing machine, the first one of which was probably introduced into the city of Philadelphia some time about 1830.

The early machine tools were of the crudest workmanship, and most of the lathes were made partly of wood. In fact, the transition from wood to iron in the construction of machinery was in progress during the early part of this century, and the formation of the tools themselves and much of the machinery built at that time involved the conversion of structural shapes required for wooden machines into similar shapes in metal. In the first change from wood to metal, architectural shapes and ornamentation were considered desirable to make machine tools and other machinery meet what seems to us now the rather barbaric taste of those who were to use them. The same might be said of locomotives, which almost up to the sixties were elaborately decorated with paint, polished brass and scroll work. England gave us the first good machine tools, and set the example which has tended to simplicity in design. To that country we owe much that is valuable, not only in the direction of self-acting machine tools but also in the various appliances for improving the character and quality of work to be accomplished. Thus Sir Joseph Whitworth, one of the earliest makers of superior machine tools in England, aimed at utility and not ornamentation in the improvement of his products. It was he who introduced surface plates for producing other plane surfaces by means of the scraper; that is to say, after a surface had been made comparatively true on the planing machine, it had yet to be brought to a commercially true plane by a process of scraping off the higher projections, until, when tested by one of the Whitworth surface plates, it seemed to touch at intervals of not more than ¼ inch.

After scraping had come to be recognized as the only means of making true plane surfaces, there followed, unfortunately, a form of deception that exists, I am sorry to say, not only in America, but still more prominently in some of the copies of American machine tools produced abroad, namely, the practice of scraping the surface without any special regard to the purpose for which the operation is intended, but rather to give it the appearance of having been carefully fitted, and the surface so produced was very aptly called by the late Mr. William B. Bement, of Philadelphia, "bedquilt scraping." The parts touched by the scraper in this imitation work are very often not irregular in design, but constitute a set figure or pattern which cannot deceive the eye of those familiar with good work.

Long before the time of the International Exhibition of 1851, America had begun to take her place in machine tool building, under a clearly distinct line of thought that was for a long time not appreciated in other countries. When visiting England, in 1884, I was shown a copy of an American planer adapted to planing the stub ends of connecting rods for locomotives, there being two sets of uprights and two cross-heads with four tool-holders adjustable in position to enable both ends of two connecting rods to be planed simultaneously. The American tool from which the idea was taken has its cross-heads facing one another, and the table is speeded to run back and forth at the same rate of cut. By this means the machine is made to take a cut at each forward and backward movement of the table. The English machine had its tool-holders facing in one direction, and all four cuts were taken at one and the same time only when the table was running forward, no work being done on the back stroke. The power of the American machine was therefore double that of its English copy, all other things being equal, and the maker was astonished when this was pointed out to him.

This one example shows how difficult it is to copy the machinery of another country if the copyist does not grasp the controlling idea of the mind that gave life to the original. Instances of this are found in many other directions where American contrivances, having obtained a world-wide reputation, are less efficient in the foreign copy than in the original production.

The planing machine is an invention well within my own experience. In the beginning it had the platen, upon which the work is fixed, dragged backwards and forwards by a chain. The first planer that William Sellers & Co. purchased and put into use was one of this chain pattern, and one was introduced in my father's shops when he undertook to build a locomotive in 1834. At the time of the Vienna Exposition, where machine tools from Philadelphia were exhibited, the engineers sent by the British Government to Vienna to note the progress that was being made noticed the broad feed cut on all the planing machines, lathes and tools that came from all parts of America, and remarked upon it as "producing good effect," as "looking well," etc., as if it were for appear-

ance only, not knowing that it was a principle that had been established in America, thoroughly understood not only by the managers of the works, but by workmen all over this country, and universally adopted as necessary to good work.

I have already referred to the slow process of boring cylinders for pumping engines. When the early locomotives were built, for example, in the Niles works, in 1856, the boring of the cylinders was done on a 36-inch lathe with a horizontal boring bar, and without any knowledge as to the theory of boring in order to produce the best results. It always took two days to bore the cylinder of a locomotive of the size in use at that time, and I think the largest cylinders were not over 15 inches in diameter. In Philadelphia, when Baldwin's had advanced to a very large establishment, they still bored the locomotive cylinders in the same way. It was not until shortly before the Centennial Exhibition of 1876 that attention was turned toward the utilization of a theory that had obtained in limited practice some years before as to the improvement in boring metals, the idea being that the quickest and best work can be done in boring by making the roughing cut with a fine feed, removing as much metal as possible by depth of cut, and making the finishing cut with a very broad feed but light cut that would let the cutter pass through the hole to be bored as quickly as possible so as not to wear the cutting edge in passage. That principle was first introduced when Mr. Asa Whitney, of this city, discovered that chilled cast-iron car wheels could be made to compete with the best wrought-iron ones and do a greater mileage. If the wheels cast in an iron mold were not allowed to cool naturally, but taken red-hot from the chill, were put into the annealing furnaces and brought up to a heat a little below the melting point, and then allowed slowly to cool, they were found to be free from all internal strains, while wheels taken red-hot from the mold would burst into three or four pieces in cooling, showing that there was violent internal strain in metal cast in that way under the tension of the heavy chill on the outside of the tread of the rim. The problem of boring chilled wheels was solved by taking advantage of the fine roughing cut and coarse finishing feed. Mr. Whitney desired to have wheels made interchangeable in their fit on the standard axles, so that when a wheel was fitted on an axle at a workshop in Philadelphia, another wheel could be furnished to fit that same axle at any future time, and just as well as the first one.

(To be Concluded.)

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market, and Some of Their Wants:—

Johnson & Noyes, 1522 Monadnock Block, Chicago, are in the market for a second-hand punch, capacity 5-inch hole in ½-inch plate. Must be in good condition.

The Inland Foundry Co. has been incorporated at Chicago, with a capital stock of 25,000, to conduct a foundry and general manufacturing business, by John H. Olmes, Chas. B. Haffenberg and Eugene Smith.

The Finley Lawn Rake Co., incorporated at Joliet, Ill., capital stock $10,000, will manufacture and deal in machinery. The incorporators are John O. Barrett, Truman A. Mason and Charles E. Finley.

The Economy Implement Co. has been incorporated at Monmouth, Ill., with a capital stock of $5 000, to manufacture vehicles, agricultural implements and tools, by Chauncey Sherrick, Walter S. Hartley and J. Ross Carpenter.

Illinois Machine & Supply Co., Chicago, capital $25 000, has been incorporated by E. I. Frankhauser, Kenneth A. Campbell, Henry A. Ritter.

The Western Roofing & Asbestos Co., has been incorporated at Chicago, with a capital of $50,000, to manufacture roofing and boiler and pipe coverings. F. H. George, E. S. Main and H. B. Rowell are incorporators.

The Seaboard Iron Co. has been organized with a capital stock of $250,000, and has taken over the furnace and other property of the Secaucus Iron Co., of Secaucus, N. J. The company will be able to handle the ore direct to the furnaces. The capacity of the furnace now constructed is 100 tons of pig iron daily, but this will be greatly increased. It was formerly owned by the A. Pardee estate, but it has not been in operation since his death three years ago. All of the $250,000 stock has been issued. The company may also construct an open-hearth furnace and manufacture cast iron pipe and later on steel tubes and steel pipe. The incorporators are Joseph R. Jackson, W. H. Maxwell, Jr., and Herbert L. May, of Secaucus, N. J.

At York, Pa., the Norway Iron & Steel Co., with a capital of $200.000, has been organized and will manufacture malleable iron and steel. The officers are: President, Charles G. Nes; vice-president, Charles James; secretary Wm. H. H. Weber; general manager, Charles James, of Philadelphia; directors, Judge W. F. Bay Stewart, John McCoy, J. W. Stacey, Charles G. Nes, D. F. Lapron, William H. H. Weber and Charles James.

The Acme Foundry Co., of Cleveland, recently incorporated, has leased the foundry of the Cleveland Foundry Co. Cast iron has been of lessening importance in the product of the latter company and it will become a customer of the Acme Foundry Co., which will operate a jobbing foundry for light gray iron castings. The new company elected the following officers last week: L. G. Krause, president; William Jassand, vice-president; William Greenbaum, secretary; C. K. Aunshine, treasurer.

Fires and Accidents:—

Fire totally destroyed the plant of the Racine (Wis.) Nail & Tack Co., Jan. 18. The loss is $35,000, with insurance, $22,000.

At Danville, Pa., the rolling mill of the Danville & Bessemer Steel Co., was damaged by fire Jan. 13 to the extent of $50.000.

The Duquesne Mfg. Co.'s plant at 26th and Liberty ave., Pittsburg, was nearly destroyed by fire Jan. 20. Loss is put at $40.000 The company manufactures stoves and gas appliances.

The foundry of the Ajax Iron Works, Corry, Pa., burned Jan. 18. Loss, $15,000. The company will rebuild.

New Construction:—

At La Moure, N. D., Henry Underwood will rebuild his machine shop recently destroyed by fire.

The Anniston (Ala.) Locomotive & Machine Works will soon commence work on a foundry building, 60x140 feet.

The Shaw Electric Crane Co., Muskegon, Mich., will erect a new pattern shop and store-house.

Silver Bros. Iron Works Co., Salt Lake, Utah, has a foundry extension under way, and a new boiler shop with other improvements together costing $25,000.

The Wheeling Mold & Foundry Co., Wheeling, W. Va., has begun work on an addition, which increasing business has made imperative.

The Newark Weldless Steel & Tube Co., Newark, O., in which Pittsburg capital is interested, will enlarge its plant. At the annual meeting recently W. E. Miller was elected president; S. V. Bishop, vice president; J. R. Goldsmith, secretary-treasurer and general manager.

The Westinghouse Electric & Mfg. Co. opened bids this week for additions to its machine shop and warehouse at East Pittsburg.

The Pittsburg District:—

The Union Switch & Signal Co., of Swissvale, Pa., notified its employes last week that the plant will hereafter be operated on double turn.

The Lewis Foundry & Machine Co., of Pittsburg, last week assigned several of its patents on parts of the McKenna old rail re-rolling mill, to the inventor of the process. In return the Pittsburg company secured the exclusive right to construct the mills. Two have already been built and are being operated successfully. In all probability a third mill will be built in New York early in the summer. The two mills in operation, at Kansas City and Joliet, have a capacity of 400 tons a day each.

The Carroll-Porter Boiler & Tank Co., of Pittsburg, has orders booked six months in advance.

Somers, Fitler & Clarke, of Pittsburg, agents for the Otto gas engine works, of Philadelphia, last week received orders for the installation of three engines. Two engines, 60 and 100 horse-power respectively, are to be installed at the plant

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Side Section.

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of the Oliver Iron & Steel Co. Zug & Co. have ordered the third. It is to be used in the operation of an electric light plant and will be of 60 horse-power.

Jones & Laughlins, Ltd., have about completed the improvements in the Bessemer steel department, by which the capacity is considerably increased. If opportunity should present itself, a further increase in capacity may be made by increasing the size of the converters from 10 to 15 tons. A new blooming mill is to be built at once, of very large capacity, and the 26-inch structural mill will be moved to another part of the works, to provide more room.

The plant of the Standard Seamless Tubing Co., at Ellwood City, Pa., was put in operation last week. Employment has already been given to about 250 men, and this force will be considerably increased shortly. The product is tubing of the larger sizes for stationary, marine and locomotive boilers, bicycle frames, hollow shafting, forgings, axles, automobiles, ordnance and mechanical tools. The seamless tubing is to supply the demand for material that will stand a high pressure. It is to be used mainly in water tube boilers and will be used exclusively in the United States Navy. The Pittsburg office of the Standard company is in the Germania Building.

The Davies Casting Machine Co., 617 Park Bldg., Pittsburg, has taken a contract with the Bethlehem Steel Co. to furnish Davies casting machines. It also has contracts with the Shenango Furnace at Sharpsville, Pa., and the Dunbar Furnace at Dunbar, Pa. All these machines are well under construction. Additional contracts are reported on which work has not yet begun. The company now has all the work it can handle for some weeks to come.

The Schiffler Bridge Co., of Pittsburg, and James Stewart & Co., of St. Louis, have been awarded the contracts for erecting the plant of the Union Switch & Signal Co., at Swissvale. The contract with the Schiffler company involves an expenditure of about $90,000 and that for the St. Louis company close to $275,000. The new plant will be a two-story brick, stone and steel building, 564 feet long and 300 feet wide. It will contain a large foundry, blacksmith shop, machine shop, carpenter shop, frog department, store room and power plant.

The Standard Coke Co. has just completed 100 new ovens at Connellsville, making 200 in all and will shortly begin the erection of 200 more at the same place. The Colonial Coke Co. has just begun the construction of 100 ovens at Smock, Fayette County, Pa.

John G. McDowell, George F. Williams, Samuel Garrison, D. H. Littell and George K. Herron will make an application for a charter in Pennsylvania, Feb. 14, for the McDowell Mfg. Co. Its product will be expanded metal fireproofing. A factory will be erected at Millvale, Pa.

The American Tin Plate Co. is reported to have closed the purchase of 2,000 acres of coal land near Monessen, Pa., several days ago. It is expected that the tin plate plant at this place is to be largely increased in capacity.

Lawrence Dilworth, Samuel T. Owens and F. C. Stoelzing, trustees of Dilworth, Porter&Co., last week transferred the Dilworth, Porter & Co. poperty to Louise G. Dilworth, Lawrence Dilworth, Mrs. Virginia C. Dilworth, Joseph R. Dilworth, Mrs. Annie W. Dil, Carter C. Beggs and Elizabeth D. Beggs, H. C. Beggs and Louise D. Beggs, Samuel T. Owens and F. C. Stoelzing, for $800,000. The transfer simply means the reorganization of the limited partnership that had expired because of the lapse of 20 years.

The buildings of the Homestead Mfg. Co., on the Monongahela River, at Homestead, have been purchased by the Carnegie Steel Co., Ltd. They will be torn down and the works extended.

At a meeting of the officers and directors of the recently organized Hussey-Truxall Co., at Pittsburg, last week, it was decided to issue preferred stock to the amount of $50,000. The company has already issued $100,000 common stock. The

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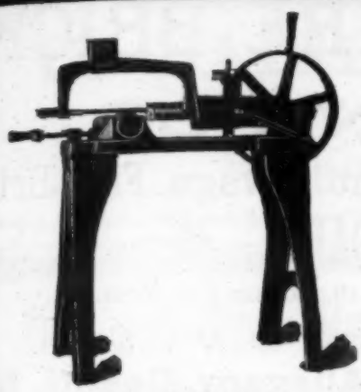

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money to be realized from the sale of the preferred stock will be used as a working capital in perfecting the plant located at New Kensington. It will be put in operation about Feb. 1, and between 100 and 200 men will be given employment. The product of the mills will be Bessemer and open-hearth steel, bars, wire rods, high grade agricultural steel, and cold rolled metal. The officers of the company are C. G. Hussey, president; J. P. McCord, vice-president; A. P. Curran, Jr., treasurer; Joseph S. Spere, secretary, and Ephraim Truxall, general manager.

Sprang, Chalfant & Co., have broken ground for the erection of the buildings which will contain their new pipe mill. It is estimated that the firm will spend about $500,000 on the new building and machinery. The site is that of the old plate mill of the company.

Moorhead Bros. & Co., operating the Vesuvius mills at Sharpsburg, will shortly make improvements costing $50,000

At the Black Diamond Steel Works of the Park Steel Co. fire in the crucible department last week caused a loss of $10,000.

Chicago District and Northwest:—

James O'Donnell, manufacturer's agent for the sale of iron and steel products, 36 La Salle st., Chicago, reports a heavy year's business in 1899. Recently he was appointed Northwestern agent for the Pittsburg Steel Hoop Co., for which he has closed a considerable tonnage; also for the Finished Steel Co., of Youngstown, O., whose specialty is shafting. Another company represented is the Diamond State Steel Co., of Wilmington, Del., who are increasing their capacity for their entire line, with expectation that they will soon make prompt shipments on boiler rivets, track bolts, horse shoes, etc. For some weeks this company has been so full of boiler rivet business that it has been unable to quote on new inquiries. The Burgess Steel & Iron Works, also represented by Mr. O'Donnell, are largely sold up for the next three months, but hope by early spring to be in a position to take on an additional amount of new business.

The Kellogg-McKay-Cameron Co., 110 Lake st., Chicago, whose business is devoted exclusively to steam and hot water heaters, pipe, fittings, valves, radiators and general steam fitters' supplies, finds a decided improvement in trade, with bright prospects for the future. In many instances buyers are purchasing goods for future requirements in anticipation of an advance in prices. There has been a larger demand during the past year than ever before. While the high prices have undoubtedly deterred some from buying, there have been a number of others who have made the aggregate much larger than usual. The company does an exclusively wholesale business and is thus brought in contact with large buyers throughout the West.

The Chicago & Northwestern Railway has placed an order for 30,000 tons of steel rails with the Illionis Steel Co. President Gary of the Federal Steel Co. said that during last week his company closed contracts for 80,000 tons of steel rails and is negotiating a foreign contract for 30,000 tons.

A strike of molders in the Lakeside Malleable Iron Co.'s plant at Racine, Wis., has been adjusted.

The E. P. Allis Co., of Miwaukee, had in 1899 its greatest year. A new shop, 60 x 250 feet, has been erected and another large building will be erected in the spring. The firm at present employs 2,400 men at Milwaukee and 350 at Buffalo. The plant at Milwaukee covers about 28 acres. The value of the yearly output of machinery is from $4,000,000 to $5,000,000.

The M. C. Bullock Mfg. Co., of Chicago, had in 1899 a marked increase in all lines of its business. The month of December being especially busy. The firm has closed an order for a hoisting plant for the Loretto Iron Co., of Wauceda, Mich., and another for the Spruce Mining Co., of Eve-

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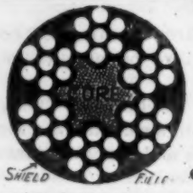

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leth, Minn., and has shipped a compressor plant to old Mexico and another to the Black Hills, a diamond drill to a mining camp near Kootenay, B. C., and three loads of engines and machinery to Australia. There are five hoisting plants and several Williams and Corliss engines going through the works. The exhibit at the Paris Exposition will consist chiefly of diamond drills.

General Industrial Notes:—

The Pioneer Furnace, at Gladstone, Mich., has been averaging above 120 tons a day and has run for short periods over 130 tons a day. The daily consumption of wood and charcoal manufactured is 240 cords, and the company's chemical works have a monthly output of 14,000 gallons of wood alcohol.

The American Coke Co., controlled by the American Steel & Wire Co., has almost completed the 230 coke ovens of the bee-hive type at the Dorothy plant in the Connellsville region. The company is making rapid headway on the two plants of 400 ovens each south of Uniontown, but they will not be ready for operation before fall.

The Superior Gas Engine Co., Marquette, Mich., shipped last week one of its 24 h. p. triple expansion engines to the Gas Engine Power Co. at Morris Heights, N. Y., where it will be put into a coasting yacht now under construction. The company has under way in its shops a 45 h. p. triple cylinder gas engine for a yacht.

At Northville, Mich., the American Bell & Foundry Co., at its recent annual meeting elected for directors F. S. Harmon, Chas. Filkins, Wm. Phillips, L. A. Beal, E. H. Lapham, R. C. Yerkes and Jas. Shaw. The directors elected F. S. Harmon, president; Charles Filkins, vice-president; L. A. Beal, secretary; and E. H. Lapham, treasurer.

The Sharon Steel Co., Sharon Pa., placed orders last week for the equipment of its new machine shop. It is to be 15 x 5 feet, and will have one 10-ton electric crane. Manning, Maxwell & Moore's Pittsburg agency and the U. Baird Machinery Co., of Pittsurgb, ahve been awarded contracts amounting to $35,000 for fitting up the new shop.

THE 20th annual meeting of the Engineers' Society of Western Pennsylvania was held in the lecture room of the socity's

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THE IRON TRADE REVIEW

Is an increasingly valuable medium through which to sell equipment to machine shops and foundries.

house, 410 Penn ave., Pittsburg, Tuesday evening, Jan. 16. The report of the treasurer showed a surplus of $500 over expenses, and an increase of membership above the 400 mark. The officers elected for the ensuing year are as follows: President, one year, W. A. Bole; vice-president, two years, C. F Scott; directors, two years, Gustave Kaufman and C. B. Albree; secretary, one year, R. A. Fessenden; treasurer, one year, A. E. Frost. The president, Harry J. Lewis, read his retiring address, in which he touched on the changes in economic conditions which have taken place in the last 20 years.

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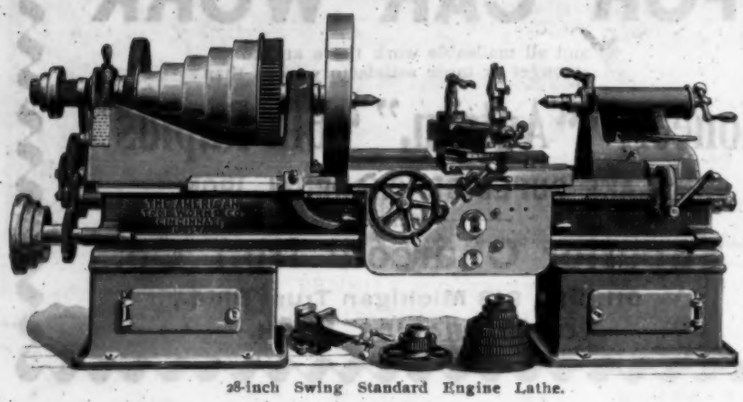

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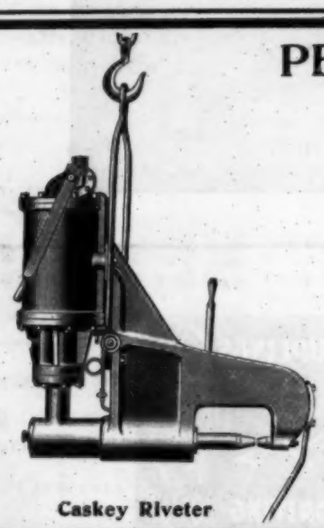

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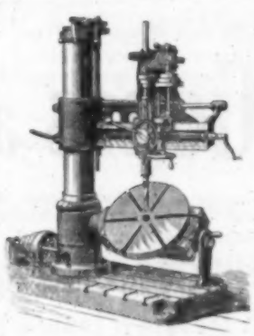

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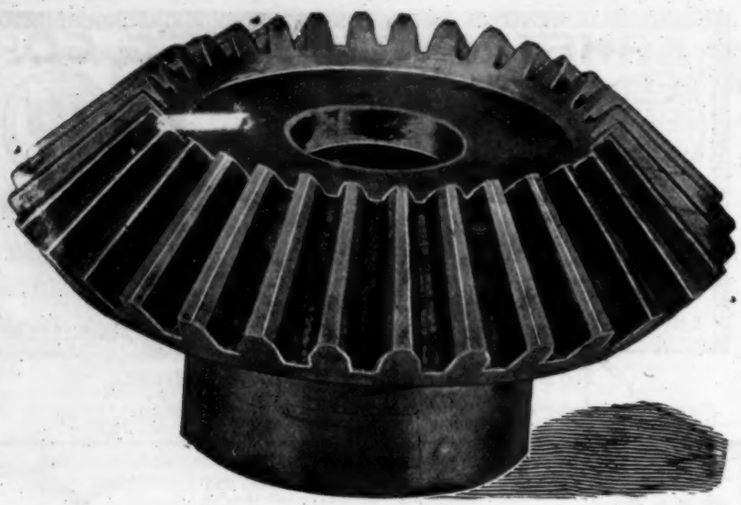

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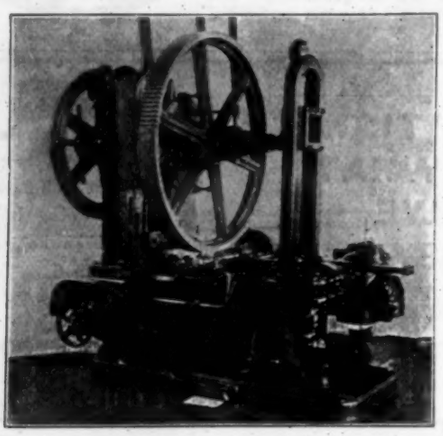

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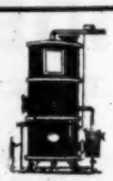

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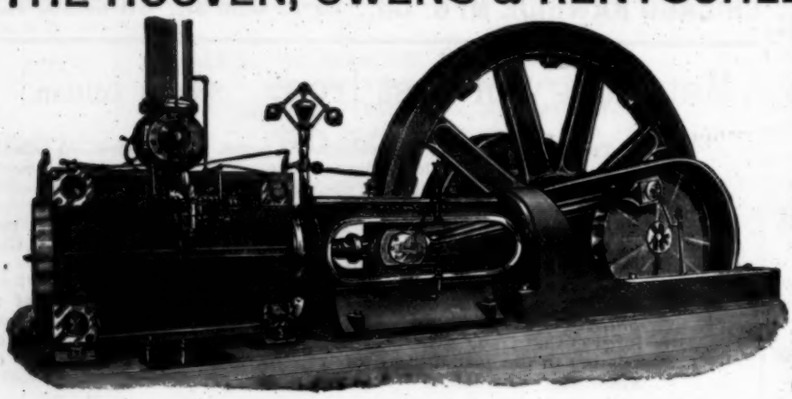

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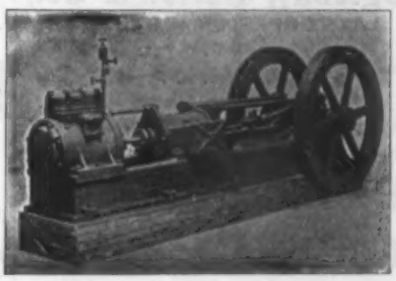

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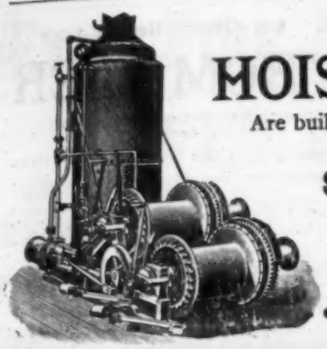

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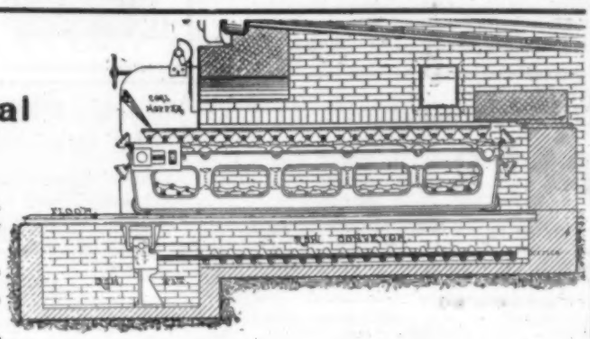

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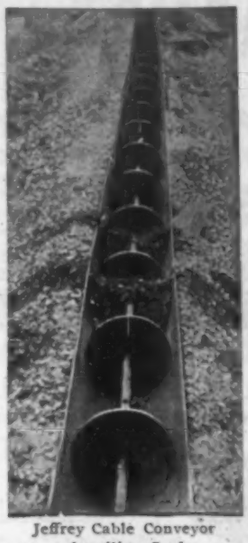

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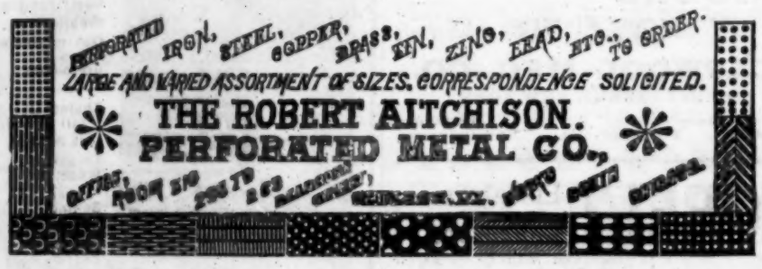
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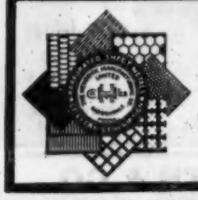

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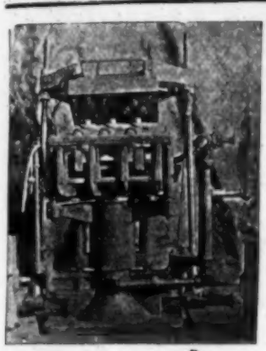

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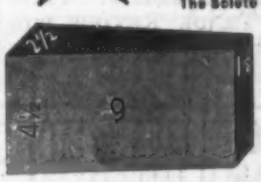

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4:25	2:25	6:27	Lorain	9:15	11:35	7:30
4:40	2:39	6:44	Elyria	9:00	11:21	7:16
4:56	2:55	7:04	Grafton	8:43	11:07	6:58
5:15	3:12	7:23	Lester	8:25	10:50	6:40
3	3	1	Main Line	3	4	6
5:30	2:25	7:20	Cleveland	8:30	11:50	7:15
5:47	2:41	7:36	Brooklyn	8:14	11:34	7:01
6:42	3:36	8:32	Lester	7:19	10:49	6:19
6:52	3:35	8:30	Medina	7:16	10:37	6:07
7:05	3:46	8:41	Chippewa La	7:04	10:26	5:55
7:20	4:01	8:56	Sterling	6:48	10:12	5:40
8:09	4:46	9:45	Massillon	6:00	9:23	4:54
8:55	5:31	10:34	Canal Dover	5:11	8:36	4:10
9:02	5:38	10:41	New Philade	5:04	8:28	4:03
9:20	6:05	11:25	Uhrichsville	4:45	8:10	3:45
.....	8:10	1:30	Bridgeport	.....	6:05	1:40
.....	8:25	.....	Bellaire	.....	5:50	.....
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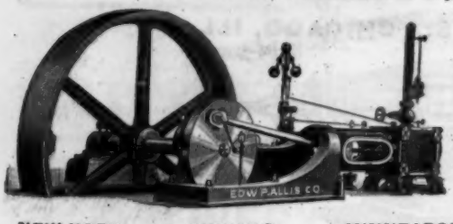

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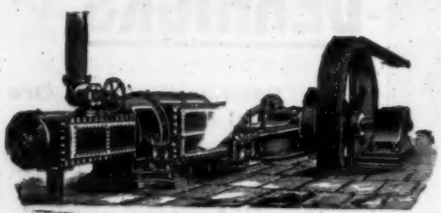

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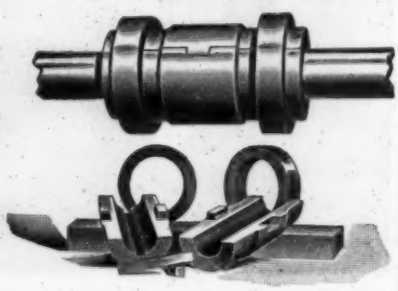

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Wm. Tod & Co., Youngstown, O.
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
Whiting Foundry Equipment Co., Harvey, Ill.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.
Excelsior Iron Works Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
Cleveland Crane & Car Co., Cleveland, O.

CRANK PINS—
Bethlehem Steel Co., S. Bethlehem, Pa.

CUPOLAS—
Riter-Conley Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co, Harvey, Ill.
The United Boiler Co., Girard, O.

CUTTER AND REAMING GRINDERS—
American Tool Works Co., Cincinnati, O.

DIES—
Danielson Machine & Tool Co., Cleveland, O.

DREDGES—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
The Jeffrey Mfg. Co., Columbus, O.

DRILL GRINDERS—
J. Wendell Cole Columbus, O.

DRILLING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

DRILL PRESSES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
Manning, Maxwell & Moore, New York City.
Danielson Machine & Tool Co., Cleveland, O.

DROP FORGINGS—
Wyman & Gordon, Worcester, Mass.
Chicago Drop Forge & Foundry Co., Kenington, Ill.
Jas. H. Baker Mfg. Co., Pittsburg, Pa.

DROP HAMMERS—
Baush & Harris Machine Tool Co., Springfield, Mass.

DROP PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
R. Konigslow & Bro., Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.

DYNAMOS—
Jeffrey Mfg. Co., Columbus, O.

EAVE TROUGHS AND CONDUCTORS—
Berger Mfg. Co., Canton, O.

ELEVATORS—
Whiting Foundry Equipment Co., Harvey, Ill.

ELEVATING AND CONVEYING MACHINERY—
Heyl & Patterson, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O
Buhl Malleable Co., Detroit, Mich.
Excelsior Iron Works Co., Cleveland, O.

EMERY AND CORUNDUM WHEELS—
Star Corundum Wheel Co., Detroit, Mich.
C. H. Besley & Co, Chicago, Ill.
J. Wendell Cole, Columbus and Chicago.
Northampton Emery Wheel Co., Chicago, Ill.
W. P. Davis Machine Co., Rochester, N. Y.

EMERY WHEEL MACHINERY—
J Wendell Cole, M.E., Columbus, O., or Chicago
Star Corundum Wheel Co., Detroit, Mich.
C. H. Besly & Co., Chicago, Ill.
Northampton Emery Wheel Co., Chicago, Ill.
W. P. Davis Machine Co., Rochester, N. Y.

ENGINEERS AND CONTRACTORS—
Wellman-Seaver Engineering Co., Cleveland, O.
Walter Kennedy, Pittsburg, Pa.
Heyl & Patterson, Pittsburg, Pa.
Meehan Boiler & Construction Co., Lowellville, O
E. E. Erickson, Pittsburg, Pa.
John T. Jones & Co., Chicago, Ill.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Julian Kennedy, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Alex Laughlin & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
James Bonar & Co., Pittsburg, Pa.

ENGINE PACKING—
Jenkins Bros., New York City.
C. H. Besly & Co., Chicago, Ill
James B. Clow & Sons, Chicago, Ill.

ENGINEERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City
James B. Clow & Sons, Chicago, Ill.

ENGINE LATHES—
U. Baird Machinery Co., Pittsburg, Pa.
American Tool Works Co., Cincinnati, O.

ENGINES (OIL)—
The Aultman Co., Canton, O.

ENGINES STEAM)—
W. P. Davis Machine Co., Rochester, N. Y
Wm. Tod & Co., Youngstown, O.
The Edward P. Allis Co., Milwaukee, Wis
The Hooven, Owens & Rentschler Co, Hamilton, O.
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, Ohio.

ENGRAVERS AND ELECTROTYPERS—
Central Electrotype & Engraving Co., Cleveland.
National Engraving Co., Cleveland, O.,
Samuel R. Mason, Cleveland, O

FEED WATER HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia, Pa.
James Bonar & Co, Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich

FELLOE PLATES—
Avery Stamping Co., Cleveland, O.

FILES, MAKERS OF—
C. H Besly & Co., Chicago, Ill.

FILTERS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

FIRE BRICK AND CLAY—
J. V. Rose, Sharon, Pa.
Union Mining Co., Mt. Savage, Md.
Clearfield Fire Brick Co., Clearfield Pa.
Dover Fire Brick Co., Cleveland, O.
F. B. Stevens, Detroit, Mich.
Chicago Fire Clay Product Co. Chicago, Ill.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
A. F. Smith & Co., New Brighton, Pa.
Chas Taylor's Sons Co. Cincinnati, O.

FIRE PROOF COVERING—
C. H. Besly & Co., Chicago, Ill.

FLEXIBLE SHAFTS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

FLUE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

FOOT AND POWER LATHES—
U. Baird Machinery Co., Pittsburg, Pa.

FORGINGS—
Chicago Drop Forge & Foundry Co., Kensington, Ill.
Cleveland City Forge & Iron Co., Cleveland, O.
Bethlehem Steel Co., South Bethlehem, Pa.
Braeburn Steel Co., Braeburn, Pa.
Wyman & Gordon, Worchester, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Samuel Trethewey & Co., Pittsburg Pa.
Jas H. Baker Mfg. Co., Pittsburg, Pa.

FOUNDRIES—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co Canton, O.
Schuylkill Iron & Steel Co., Philadelphia, Pa.
Stover Gasoline Engine Works, Freeport, Ill.
Riverside Foundry Co., Cleveland, O.
I. & E. Greenwald Co., Cincinnati, O.
Wheeling Mold & Foundry Co., Wheeling, W.Va.
Excelsior Iron Works Co., Cleveland, O.
Macbeth & Co., Cleveland, O.
Vulcan Foundry & Machine Co., New Castle, Pa

FOUNDRY EQUIPMENT.
Tabor Mfg. Co., Elizabeth, N. J.
Brass Founders Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Cleveland Crane & Car Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

FOUNDRY FACINGS—
Cleveland Facing Mill Co., Cleveland, O.

FOUNDRY SUPPLIES—
Northern Engineering Works, Detroit, Mich.
Chas. Taylor's Sons Co., Cincinnati, O.
Clearfield Fire Brick Co., Clearfield, Pa.
Cleveland Crane & Car Co, Cleveland, O.
The Ohio Sand Co., Connesut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland, O.
A. F. Smith & Co., New Brighton

Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
Cleveland Facing Mill Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

FRICTION METAL—
James B. Clow & Sons, Chicago, Ill.
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Magnolia Metal Co., New York City.
Perfect Lubricating Metal Co., Cincinnati, O.
F. R. Phillips' Sons Co., Philadelphia, Pa.
J. J. Ryan & Co., Chicago, Ill.

FURNACES—
Playford Stoker Co., Cleveland, O.

FURNACE LININGS—
Union Mining Co., Mt. Savage, Md.

FURNACE, MELTING—
Whiting Foundry Equipment Co., Harvey, Ill.

FUEL OIL BURNERS—
W. S. Rockwell & Co., New York City.

GALVANIZED IRON—
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZERS—
Ætna-Standard Iron & Steel Co., Bridgeport, O
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZING POTS—
The Wm. B. Pollock Co., Youngstown, O.

GAS ENGINES—
Northern Engineering Works, Detroit, Mich.

GAUGE COCKS—
James Bonar & Co., Pittsburg, Pa.

GEARING—
I. & R. Greenwald Co., Cincinnati, O.
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
F. H. Bultman & Co., Cleveland, O.
Fraser & Chalmers, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

GEAR CUTTERS—
F. H. Bultman & Co., Cleveland, O.

GEAR CUTTING—
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
F. H. Bultman & Co., Cleveland, O.

GEAR LUBRICANTS—
The Ironsides Company, Columbus, O.

GIRDER WORK—
Wm. B Scaife & Sons, Pittsburg, Pa.

GRINDSTONES—
C. H. Besly & Co., Chicago, Ill.

GRAPHITE PAINT—
Jos Dixon Crucible Co., Jersey City, N. J.

GRATE BARS—
Geo. B. Sennett Co., Youngstown, Ohio.

GRAY IRON CASTINGS—
W. A. Jones Foundry Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.

HACK SAWS—
Q & C Co., Chicago, Ill.

HANGERS—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & R. Greenwald Co., Cincinnati, O.

HARNESS SNAPS—
Covert Mfg. Co., West Troy, N. Y.

HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.
The United Boiler Co., Girard, O.

HEAVY HARDWARE—
C. H. Besly & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.

HOISTS—
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

HOISTING ENGINES—
The Edward P. Allis Co., Milwaukee, Wis.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Excelsior Iron Works Co., Cleveland, O

HOISTING MACHINERY—
Link-Belt Machinery Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O
Excelsior Iron Works Co., Cleveland, O.
Lidgerwood Mfg. Co., New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.

HORSE SHOES—
Phoenix Horse Shoe Co., Joliet, Ill.

IMPULSE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

INDUSTRIAL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

INGOT MOLDS—
Lorain Foundry Co., Lorain, O.

INJECTORS—
C. H. Besly & Co., Chicago, Ill.
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

INSURANCE COMPANIES—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

IRON BUILDINGS—
Illinois Steel Co., Chicago, Ill.
Schiffler Bridge Co., Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON, NAILS AND STEEL—
C. H. Besly & Co., Chicago, Ill.
R. H. Stroud & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.
L. K. Hirsch, Chicago, Ill.

IRON AND STEEL ROOFING—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O
Cincinnati Corrugating Co., Piqua, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.
J. Wesley Pullman, Philadelphia, Pa.
Tod, Stambaugh & Co., Cleveland, O.

IRON ORE—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
Pickands, Brown & Co., Chicago, Ill.
M. A. Hanna & Co., Cleveland, O.
Drake Bartow & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.

IRON WORKING TOOLS—
Avery Stamping Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Armstrong Bros. Tool Co., Chicago, Ill.
F. H. Bultman & Co., Cleveland, O.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
W. P. Davis Machine Co., Rochester, N. Y.
Manning, Maxwell & Moore, New York City.
Bertsch & Co., Cambridge City, Ind.

LADLES—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
The United Boiler Co., Girard, O.

LATHES—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

LINK BELTING—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.

LOCOMOTIVES—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

MACHINISTS' TOOLS AND SUPPLIES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Parkhurst & Wilkinson Co., Chicago, Ill.
Baush & Harris Machine Tool Co., Springfield Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
F. H. Bultman & Co., Cleveland, O.

MACHINE SCREWS—
C. H. Besly & Co., Chicago, Ill.

MACHINE SHOPS—
The R. D. Nuttall Co., Allegheny, Pa.
Danielson Machine & Tool Co., Cleveland, O.

MACHINERY AND TOOL STEEL—
C. H. Besley & Co., Chicago, Ill.
Braeburn Steel Co., Braeburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.

MAGNESIA COVERING—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

MALLEABLE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

MALLEABLE CASTINGS—
Acme Malleable Iron Works, Buffalo, N. Y.
Buhl Malleable Co., Detroit, Mich.

MANUFACTURING CHEMISTS—
We Fu Go Co., Cincinnati, O.
Grasselli Chemical Co., Cleveland, O.

MANUFACTURED IRON AND STEEL—
Bourne-Fuller & Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Parkhurst & Wilkinson Co., Chicago, Ill.
Ohio Steel Co., Youngstown, O.
Republic Iron & Steel Co., Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.

METAL BEARINGS—
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Magnolia Metal Co., New York City.
Swarts Metal Refining Co., Chicago, Ills.
F. R. Phillips' Sons Co., Philadelphia, Pa.
J. J. Ryan & Co., Chicago, Ill.

METAL CEILINGS—
Berger Manufacturing Co., Canton, O.

METAL WORK—
Avery Stamping Co, Cleveland, O.

MILL CASTINGS—
Vulcan Foundry & Machine Co., New Castle, Pa.
Schuykill Iron & Steel Co., Philadelphia, Pa.

MILLING MACHINES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

MINING MACHINERY—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Wm. Cramp & Sons, Philadelphia, Pa
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Excelsior Iron Works Co., Cleveland, O.

MINE PUMPS—
F. M. Prescott Steam Pump Co., Milwaukee, Wis.

MOLDING MACHINES—
Tabor Mfg. Co., Elizabeth, N. J.
Whiting Foundry Equipment Co., Harvey, Ill.

MOLDING SAND—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

MULTIPLE DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.

NICKEL PLATING OUTFITS—
Northampton Emery Wheel Co., Chicago, Ill.

NUTS AND BOLTS—
Upson Nut Co., Cleveland, O.

OILLESS BEARINGS—
C. H. Besly & Co., Chicago, Ill.

OIL BURNERS—
W. S. Rockwell & Co., New York City.

OIL CUPS—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

OIL FILTERS—
James Bonar & Co., Pittsburg, Pa.

OIL PUMPS—
C. H. Besly & Co., Chicago, Ill.

OIL SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.
American Tool Works Co., Cincinnati, O.

ORE CARS—
The Pressed Steel Co. Pittsburg, Pa.

ORE CRUSHERS—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers Chicago, Ill.

ORE SCREENS—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

ORE TESTING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

PACKING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.

PAINT—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.

PATTERN WORKS—
Gobeille Pattern Co., Cleveland, O.
Forsythe Pattern Works, Youngstown, O.

PERFORATED METALS—
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.

PIG IRON—
Rogers, Brown & Co., Cincinnati, O.
Reed F. Blair & Co., Pittsburg, Pa.
Clinton Iron & Steel Co., Pittsburg.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
R. H. Stroud & Co., Chicago, Ill.
Pickands, Brown & Co., Chicago, Ill.
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Spearman Iron Co., Sharpsville, Pa.
Hickman, Williams & Co., Chicago, Ill.
The Brier Hill Coal & Iron Co., Youngstown, O.
Pickands, Mather & Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.

PIG IRON CASTING APPARATUS—
Heyl & Patterson, Pittsburg, Pa.
G. H. Ginther, Special Agent, Pittsburg, Pa.

PIPE (CAST IRON)—
James B. Clow & Sons, Chicago, Ill.

PIPE (RIVETED STEEL)—
Wm. B. Scaife & Sons, Pittsburg, Pa.

PIPE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

PIPE COVERING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

PIPE CUTTING AND THREADING MACHINES—
The Armstrong Mfg. Co., Bridgeport, Conn.

PIPE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

PISTON RODS—
Bethlehem Steel Co., So. Bethlehem, Pa.

PLANERS—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

PLATES—
Enterprise Boiler Co., Youngstown, O.
Republic Iron & Steel Co., Chicago, Ill.
Illinois Steel Co., Chicago, Ill.

PLUMBERS' AND GAS FITTERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

PNEUMATIC APPLIANCES—
Clayton Air Compressor Works, New York.
Q & C Co., Chicago, Ill.
W. J. Schaefer & Co., New York City.

PORTABLE FORGE—
C. H. Besly & Co., Chicago, Ill.
Vulcan Mfg. Co., Pittsburg, Pa.

POWER DROP HAMMERS—
Baush & Harris Machine Tool Co., Springfield Mass.

POWER PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.

POWER TRANSMISSON MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.

PRESSES—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Avery Stamping Co., Cleveland, O.

PRESSURE GAUGES—
The Bristol Co., Waterbury, Conn.
James Bonar & Co., Pittsburg, Pa.

PULLEYS—
W. A. Jones Foundry Co., Chicago, Ill
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.

PUMPS (STEAM)—
The Edward P. Allis Co., Milwaukee, Wis
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.

PUNCHES—
E. Konigslow & Bro. Cleveland, O.

PYROMETERS—
Edward Brown, Philadelphia, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.

RADIAL DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
American Tool Works Co., Cincinnati, O.

RAILS—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

RAILWAY SUPPLIES—
Cleveland City Forge & Iron Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
L. K. Hirsch, Chicago, Ill.

RELAYING RAILS—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

RIVETS—
Champion Rivet Co., Cleveland, O.
Jonse & Laughlins, Ltd., Pittsburg, Pa.

RIVETED STEEL PIPE—
The Wm. B. Pollock Co. Youngstown, O.

ROCK DRILLS—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.

ROLL FORGINGS—
Samuel Trethewey & Co., Pittsburg, Pa.

ROLLING MILL MACHINERY—
The United Boiler Co., Girard, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
P. R. Phillips' Sons Co., Philadelphia, Pa
Whiting Foundry Equipment Co., Harvey, Ill.
The Lloyd Booth Co., Youngstown, O.
Vulcan Foundry & Machine Co., New Castle, Pa.

ROOFS—
Shimer Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.
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Alphabetical List of Advertisers.

The star (*) indicates that the adv. appears alternate weeks; the dagger (†) once a month; the double dagger (‡) once in three weeks; the parallel (‖) three times out of four.

	PAGE
Acme Malleable Iron Works	2
Ætna-Standard Iron & Steel Co	30
Ætna Fire Brick Co	33
Aitchison, Rob't, Perforated Metal Co	34
Allis & Co., Edward P	42
American Carburising Co	29
American Steel Hoop Co	38
American Steel & Wire Co	37
American Tin Plate Company	39
American Tool Works Co	26
Apollo Iron & Steel Co	1
Armstrong Bros. Tool Co	1
Armstrong Mfg. Co	27
Aultman Co	2
Austin Separator Co	47
Avery Stamping Co	48
Baird Machinery Co., U	23
Baker Mfg. Co., James H	26
Baush & Harris Machine Tool Co	48
*Berger Mfg. Co	—
*Bertsch & Co	—
Besly & Co., Chas. H	48
Bethlehem Steel Co	47
*Bickford Drill & Tool Co	27
Bickford, H	48
Blair & Co., Reed P	2
Blakeslee Mfg. Co	1
Bonar & Co., James	28
Booth Co., The Lloyd	35
Bourne-Fuller Co	1-2
Brœburn Steel Co	34
Brass Founders' Supply Co	33
Bristol Co., The	1
*Brown, Edward	—
Brown Hoisting and Conveying Machine Co	31
Bucyrus Co	24
Buhl Malleable Co	22
Bultman & Co., F. H	28
Cahall Sales Department	1
Central Electrotype & Engraving Co	35
*Champion Rivet Co	25
Chicago Drop Forge & Foundry Co	1
Chicago Fire Clay Product Co	33
Chicago Press Clipping Bureau	31
*Chicago Rawhide Mfg. Co	27
Chicago Screw Co	1
Cincinnati Corrugating Co	1
Clayton Air Compressor Works	2
Clearfield Fire Brick Co	33
Cleveland Ball & Screw Co	27
Cleveland City Forge & Iron Co	4
Cleveland Crane & Car Co	31
†Cleveland Facing Mill Co	—
Clinton Iron & Steel Co	30
Clow & Sons, James B	2
Cole, J. Wendell	48
Covert Mfg. Co	27
Cramp & Sons, Wm	24
Cremer & Bicknell	32
Crescent Steel Co	34
Danielson Machine & Tool Co	48
Davis Machine Co., W. P	27
Denison, Prior & Co	33
Delano, E. A	47
Detroit & Cleveland Navigation Co	38
Dixon Jos., Crucible Co	24
*Dodge Mfg Co	25
Dover Fire Brick Co	33
Drake, Bartow & Co	30
Ellis Manufacturing Co	40
Emmerton, F. A	2
Enterprise Boiler Co	1
Erikson, Edward E	23
Excelsior Iron Works Co	41
Fitzsimons & Co	34
*Fix Sons	32
Forsythe Pattern Works	34
Fraser & Chalmers	24
Frick Coke Co., H. C	1
Gandy Belting Co	48
Garden City Sand Co	33
Gerlach, Peter & Co	34
Ginther, G. H	36
Gobeille Pattern Co	34
Goodyear, S. W	27
Grasselli Chemical Co	24
Greenwald Co., I. & E	42
Hall Steam Pump Co	29
Hanna & Co., M. A	30
Harrison Safety Boiler Works	20
Hartford Steam Boiler Insp. & Ins. Co	24
Hendrick Mfg. Co., The	32
Hercules Steel Casting Co	20
Heyl & Patterson	29
†Hickman, Williams & Co	—
Hiertz & Son, Theo	2
Hirsch, L. E	2
Holmes, Strachan & Co	35
Hooven, Owens & Rentschler Co	28
Hunt Robt. W., & Co	2
Hyde Bros. & Co	40
Illinois Central R. R	34
Illinois Steel Co	40
Ingersoll-Sergeant Drill Co	2
Iron Clad Paint Co	41
Ironsides Co	22
Jeffrey Mfg. Co	31
Jenkins Bros	24
Jones & Co., John T	2
Jones Foundry & Machine Co., W. A	1
Jones & Laughlins, Ltd	39
Kennedy, Julian	32
Kennedy, Walter	35
Kentucky Fire Brick Works	33
Keystone Driller Co	47
Konigslow & Bro., R	27
La Belle Steel Co	34
Lake Superior Consolidated Iron Mines	30
Laughlin & Co., Alex	32
Lidgerwood Mfg Co	31
Link-Belt Machinery Co	31
Lorain Foundry Co	35
Lorain Steel Co	39
Macbeth & Co	33
Magnolia Metal Co	2
Mason, Samuel R	27
Main Belting Co	27
Manning, Maxwell & Moore	26
Marion Steam Shovel Co	48
McKeefrey & Co	30
Meehan Boiler & Construction Co	48
Moffat & Co., Geo. D	34
Monongahela Iron & Steel Co	34
Morris & Bailey Steel Co	34
National Engraving Co	29
National Steel Co	36
National Tube Co	36
†Newport Sand Bank Co	—
Northampton Emery Wheel Co	41
Northern Engineering Co	31
Nuttall Co. The R. D	28
Oak Hill Fire Brick & Coal Co	23
Oglebay, Norton & Co	30
†Ohio Sand Co	—
Otis Steel Co	22
†Parkhurst & Wilkinson Co	—
Perfect Lubricating Metal Co	48
Phillips' Sons Co., P. R	1-35
Phœnix Horse Shoe Co	23
Pickands, Brown & Co	30
Pickands, Mather & Co	30
Playford Stoker Co	31
Pollock, The Wm. B. Co	2
Prescott Steam Pump Co	29
Pressed Steel Car Co., The	38
*Pullman, J. Wesley	40
Q & C Co	21
Rand Drill Co	2
Republic Iron & Steel Co	38
Riter-Conley Mfg. Co	32
Riverside Foundry Co	22
Rogers, Brown & Co	1-21
*Rockwell & Co., W. S	1—
Ryan, J. J. & Co	34
Scaife & Sons, Wm. B	47
Schaefer & Co., W. J	48
Schuylkill Iron & Steel Co	47
Scioto Star Fire Brick Works	33
Seaman, Sleeth Co	35
Sennett Co., Geo. B	42
‖Sharon Fire Brick Works	1
Shiffler Bridge Co	32
Smith & Co. A. P	31
Southwark Foundry and Machine Co	42
Spearman Iron Co	48
Star Corundum Wheel Co	33
Stevens, F. B	48
Stover Gasoline Engine Works	40
Stroud & Co., E. H	2
Struthers Iron & Steel Co	1-30
*Superior Charcoal Iron Co	25
Swarts Metal Refining Co	1
Tabor Mfg Co	33
Taylor's Sons Co., Chas	23
Textor, O	2
Tod, Stambaugh & Co	30
Tod, Wm. & Co	42
Totten & Hogg Iron & Steel Foundry Co	35
Trethewey & Co., Ltd., Samuel	34
Union Mining Co	22
Union Boiler Tube Cleaner Co	1
United Boiler Co	32
Upson Nut Co	1
Van Dorn & Dutton Co	28
Vermillion Pine & Iron Land Co	48
Vulcan Foundry & Machine Co	31
Vulcan Mfg. Co	32
Webster, Camp & Lane Machine Co	23
Webster Fire Brick Co	1
Wellman-Seaver Engineering Co	32
†Wefugo Co	—
Wheeling Mold & Foundry Co	48
White Byron H	34
Whiting Foundry Equipment Co	33
Wyman & Gordon	47

DIRECTORY

To the Iron and Steel Works of the United States for 1898.

PUBLISHED BY
THE AMERICAN IRON AND STEEL ASSOCIATION.

Thoroughly Revised. Price, Seven Dollars.

The American Iron and Steel Association has just completed a thorough revision of its Directory to the Iron and Steel Works of the United States, bringing down to April, 1898, a description of these works. It also contains a complete Directory to many leading industries which are large consumers of iron and steel. This edition, which is the fourteenth that has been issued, embraces more complete details of all the iron and steel works of the United States, and of industries which are large consumers of iron and steel, than any preceding edition. It retains all the old features of preceding editions and contains many new features.

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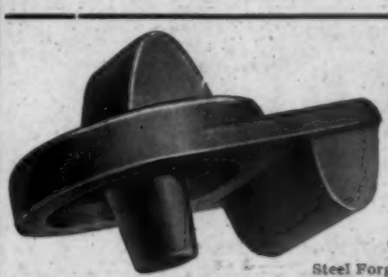

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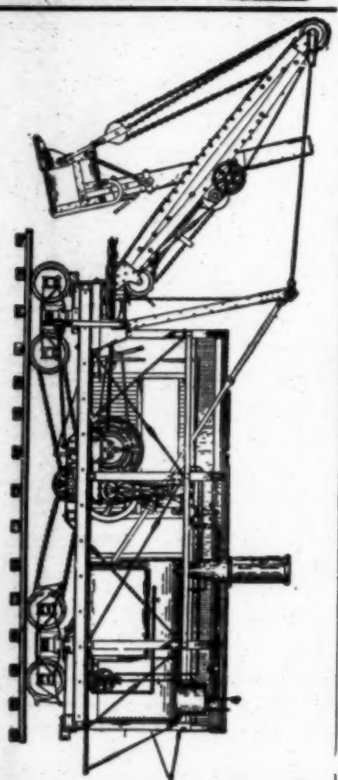

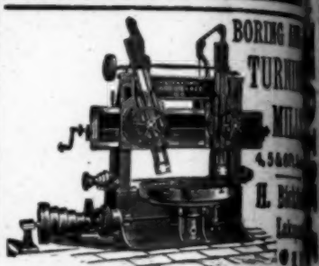

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